INAPPROPRIATE DEVELOPMENT, ENGINEERING IDEOLOGY AND THE CORPORATIST VISION IN ITALY, 1890-1929

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SUMMARY

The thesis was conceived as an effort to contribute to three more or less distinct academic disoourses, by attempting to analyze the relationship between them. These fields of study are: 1) technology as social and political process, and the related category of scientific management as ideology in industrial capitalism; 2) the corporatist conception of political organization; 3) the contemporary debate on appropriate development and alternative technology for today's poor countries. The historical phenomenon invoked as the mediating element in trying to unite these categories is corporatist reformism in inter-war Italy.

The bulk of the thesis is an attempt to examine this reformism as it was expressed by the engineering community. It is argued that the generic tensions in industrial capitalism between technological rationality in the organization of production and the opposing fragmentary pressures applied by economic competition - tensions which emerged in the social philosophy of technocracy - were also present in the articulation of corporatist ideology in Italy.

The historical feature of Italian development which gave the political push to the engineering ideology was, it is suggested, the legacy of dependent and inappropriate industrial development. Thus economic weakness because of an unsuccessful development model which conformed little to factor endowment - the 19th century British model - encouraged social reformism to be conceived in terms of technological solutions.

The resulting reform conception - technocratic corporatism - was however merely ideology, and as such emerged to conceal failed practice. Apart from investigating the engineers' conception of reform, therefore, the thesis also traces the failures to implement reform at a technical level, which the success of the corporatist model presupposed.

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The system was invisible,which made it all the more impressive, all the more disquieting to deal with. But we were in accord, at least for now. The networks, the circuits, the streams, the harmonies.

- Don Delillo,
White Noise

Introduction

In 1977, David Noble introduced his book America By Design with the following statement:

> Modern Americans confront a world in which everything changes, yet nothing moves. The perpetual rush to novelty that characterizes the modern marketplace, with its escalating promise of technological transcendence, is matched by the persistence of pre-formed patterns of life which promise merely more of the same. Each major scientific advance, while appearing to presage an entirely new society, attests rather to the vigor and resilience of the old order that produced it. Every new, seemingly bold departure ends by following an already familiar path. This book is an attempt to begin to explain this strange state of affairs: a remarkably dynamic society that goes nowhere. [1]

He then goes on to chart the history of the institutional mechanisms whereby the physical means which provided American society with its dynamism - science based technology - simultaneously served to freeze relations of power and property in the form of the modern corporate order. The idea here was that the modern integrated corporate form developed and expanded in step with twentieth-century science based technology; that each is inconceivable without the other, the social and the technical being necessary complementary features of a single process. This is to conceive historically specific social institutions - or the social structure of accumulation in capitalist societies, as termed in a recent work [2] - as part of the history of technology.

An analytical tool that can be usefully employed to further illustrate and elaborate the idea is the concept of "isomorphism", as described by Douglas Hofstadter. [3] An isomorphism exists when two complex structures, sets of symbols or abstract categories - created for purposes of analysis and, although derived from "facts", are not themselves "facts" - can be mapped on to each other, in as much as the two structures contain the same information, though the information may not be presented or ordered in the identical way. Clearly, this

mapping together of structurally or conceptually similar entities could only result in producing merely a larger copy of the same information that is contained in the components. A "dynamic system that goes nowhere", simply because it does nothing more than continually reproduce itself.

In recent years a substantial body of research has been done with the aim of identifying such a correspondence, or "isomorphism", between the means by which society produces for itself (technology) and the institutional relations within which such production takes place. This is essentially a revival of a long standing debate about the relationship, or identity, between "forces" and "relations" of production. In this literature the aim is to demonstrate that in producing objects, society is also producing social relations in the process, through the division of labour inherent in certain forms of physical production. In its evolution, however, technology has increasingly assumed the guise of an autonomous social force, uncontrolled and uncontrollable by the conscious will of individuals. This, it is argued, is a simple failure to perceive the structural "isomorphism" between the hardware of production and the relations in the social world which technology carries and reproduces. The technological process that evolves thus serves to simultaneously mirror and reproduce the society in which it was conceived.[4]

Detailed empirical investigations of this isomorphism however are as valuable as they are relatively scarse. Apart from obvious technical problems of methodology - i.e. the absence of documentation may merely be testimony to the total absence of open consultation between contending parties on the way things will be produced - the reason for this relative dearth of more detailed research is no doubt due to the topic itself being a type of analytical fiction, wholly based on a particular interpretation of certain facts and, therefore, quite clearly, beyond only a nominal degree of "provability". Since any analytical approach

or methodology could be subject to the same criticism, this need not diminish the strength of the argument. In the end, since all theoretical models in the social sciences (or implied models) assume some more or less arbitrarily chosen notion of equilibrium, and therefore some arbitrarily selected dynamic factors that provoke social change, assessment of the model comes down to rather more mundane questions of interests and "relevance". Any theoretical formulation based on social data will necessarily suffer this "weakness", and the greater or lesser degree of abstraction of the model in no way effects this.[5]

A second level on which the same problem has been dealt with concerns not how socially conditioned factors impinge on technical work, but rather how the mutually reinforcing relationship between the two takes concrete form in the labour process, and its controlling element, modern management. This was a problem virtually given new life by a single work in 1974 - Harry Braverman's Labor and Monopoly Capital - and practically creating a discipline unto itself.[6]

Taken overall, the identification of the problematic represented by these works has been, in itself, a decisive contribution to knowledge. Apart from whatever purely academic interest such arguments may have, they are clearly of considerable importance to poor countries looking to avoid entrapment in the treadmill of technological dependence, as well as being issues kept very much alive in the industrialized world by "socially useful production" schemes, such as that, for example, formulated by the Lucas Aerospace engineers and workers in the U.K. in the late 1970s.[7]

There is, finally, a third level on which to approach these questions, which is how I conceived the contribution of the present thesis. This is how structural changes associated with new forms of production - giving rise to the isomorphism between the technological

and social/hierarchical components of production processes, represented by the common medium of modern management - impinged on politics and culture in the special case of 1920s Italy.

The basic question under investigation in my research is the nature of the historical relationship between fascist corporatism as a model for social organization, and the contemporary internal transformation of industrial capitalism in Italy. How can fascist reformism be understood in relation to industrial planning strategies that emerged after world war I in response to specific structural changes in the organization of production? What kind of connections could be found - both individual and institutional - between fascist programs for institutional renovation in Italian society and the contemporary development, in Europe as a whole, of an engineering vision of productive planning that was partly an import from the United States and partly a response to indigenous circumstances? At which points did these parallel developments - the political and the industrial - merge and for which historical reasons?

My idea is simply that the system of economic reasoning that underpinned the logic of the technocratic-corporatist model could be reasonably expressed as a formalization on a higher level of historically determined features of social production in Italy, operating, so to speak, at the "hardware" level of society. Indeed, one of the fundamental goals of the thesis is an attempt to encourage a mode of viewing the development of the theory and practice of social organization in 1920s Italy which integrates phenomena operating at very "high" and "low" levels of social organization. The thesis argues that not only were changes internal to production-- mainly technological - part and parcel of a massive reallocation of resources in the economy - the rise

of concentrated, corporate enterprise - but at the meeting point of the two - the expanding engineering function of planned management - lies an important vehicle for understanding inter-war Italian corporatist reformism.

Corporatist fascism was perhaps the first important system of social organization of this century to claim its working model would be informed by the framework offered by science-based production systems. Hierarchy, order, efficiency, standardization, streamlining, integration - these are some of the catch words and phrases that were commonplace in the political discourse of Italian fascism. They are of course almost all culled directly from the lexicon of corporate management and, in particular, from engineers functioning as managers.

Underpinning the evolution of such a discourse lay a process of resource allocation in the Italian economy that was fundamentally new. The only significant growth during the period occurred in production spheres that had a much greater dependence on theoretical science, and that dictated new criteria in the formulation of investment decisions and planning strategies. At this point in industrial history - when the stable utilization of capacity required very close monitoring of inter-industry sales of inputs throughout the system - questions of planning and scheduling became paramount. An "industry" could no longer be considered as a group of companies that shared industrial processes or products. Rather, it would have to be defined as a set of firms using different processes and producing different goods but connected as suppliers and over-lapping in the end-use function they fulfilled.

The methods and techniques that were formulated within industrial corporations to stabilize and control the traffic in production inputs came, in the post world war I period, to be viewed as analytical tools that could be used in planning for a stable social order as a whole. The managerial model for political society was an important feature

of a broadly based reform movement - sometimes calling itself corporatist, sometimes not - that spread throughout Europe and North America between the wars.

In Italy, however, productivist ideas and scientific management were diffused, not only as strategies for economic growth, but also very much as technical answers to profound social, historical and political problems. In the view of Charles Maier,[8] these problems were primarily the absence of a strong social base for democratic practices, and the impossibility of reactionary dominance by the powerful agrarians. Such a configuration encouraged the articulation of a "third way" to the problems of capital and labour. In the absence of the chance for representative democracy to take hold, the engineering vision found fertile ground in which to root itself. Both early corporatist ideology and the ascending engineering vision, subscribing to a functional criterion of power, had developed in parallel fo fill the vacuum left by political failure. In the true spirit of engineering rationality, corporatist fascism declared itself to be the Third Way between marxian socialism and the unregulated capitalism of the marketplace. "An industrial paradigm for political society," as Maier summarized it.

My own search for explanation has led me to emphasize features of the industrialization process itself in Italy. Informing my analysis with contemporary arguments about alternative technologies for third world countries,[9] and the work of Sidney Pollard on European industrialization,[10] I have found the concept of "inappropriate" development a useful analytical category. As Pollard analyzed in detail, the industrialization process in Europe should be viewed as a single process, emanating from Britain as a transfer of technology (including mechanical skills and particular techniques for resource exploitation) and spreading

throughout the continent. The important point is that these skills, techniques and technologies had been developed in a very specific institutional, legal and cultural environment, and, perhaps most importantly, given a specific endowment of production factors. The tensions created by the transfer of these production systems, skills and technologies into a very different social context having different resources to exploit plays a very important part in my analysis.

Italy, like many other areas, only partially industrialized on the basis of the British iron and coal model, given, however, radically different social and economic resources at its disposal, ensuring high production costs and a dependent and peripheral economic status. I believe that many of the tensions created by the contradictions of such inappropriate models of development lie very much at the root of subsequent authoritarian reformism in the 1920s, founded on the rhetoric of "efficiency". A country relegated to a dependent status and uncompetitive productivity levels, primarily through technological mechanisms, is perhaps logically predisposed to conceive liberation through the same mechanisms, and the productivist discourse of corporatist reformism embodied the tensions that the legacy of inappropriate development had produced.

This discourse was however ideology, and as such existed to conceal contradictions and failed practice. It was precisely the weak technical and organizational base of the Italian industrial economy that produced its opposite in the claims and rhetoric of corporatist reformers. The more precarious was the relationship between technocratic reform and social reality, the more internally formalized and self-referential became the discourse. A large part of the material presented in the thesis is precisely an attempt to discuss this failed practice. Indeed, the tensions which resulted, and which gave rise to the corporatist

concept also, by their very existence, belied the possibility of the reformist model ever being realized in practice. This is the contradiction that permeates the study of this aspect of Italian fascism, and is probably why most scholars have chosen to ignore of dismiss the abyss between the model and the practice of corporatist fascism as unimportant, rather than perhaps seeing in the contradiction itself the essence of the problem. Trying to confront this contradiction head on and explain its development in a particular historical context - through a study of the tensions between the forces of economic development and stagnation, and the ambiguous role of the technical expert in the middle - is one of the primary aims of the thesis.

In a study concerned with the political function of engineering and industrial priorities for social organization, the figure of the engineer himself must play a central role. Generally speaking, the engineer is a neglected political actor in the historiography of our century, an oversight which I believe to be especially grave where Italian corporatist fascism is concerned. A profession virtually created anew by the confluence of theoretical science and engineering in the late nineteenth and early twentieth centuries, the engineer soon found himself to be corporate organizer, planner, accountant and statistician. And all the techniques, models and operations that he had used to streamline corporate business were merely extended into a vast project of social re-modelling.

All this is particularly relevant to the corporatist movement, which saw in the industrial engineer the expert most suited to realize the goals of the "historically necessary" corporate state, to resolve the contradictions between the new "machine civilization" and the financial imperatives of the modern joint-stock company. As the basic lines of the analysis went, the massive capital requirements of continuous

production systems that had given rise to the modern joint-stock company had also permanently placed in conflict "technological" and "business" interests in the running of the economy, the inherent rationality of corporate production being cast against the irrational imperative of producing profit and dividends for financial interests having no direct function in the production process. The overall reform drift of the time then was to create the conditions for economic and social stability by bringing the model of corporate rationality into a scheme of societal planning as a whole. And the "neutral" figure of the corporate engineer-manager, himself a creation of the process of separating ownership and management in industrial production, was to be the protagonist in streamlining and harmonizing competing interests. From his intrinsic role as mediator and integrator of the traditionally contending camps of capital and labour, through his position as the active subject in the design and organization of the means of production, the engineer-manager's function would be institutionalized at the level of political organization, to effect a merging of the traditionally separate worlds of politics and economics.

The creation of modern management, the product of the fusion of science based engineering and the corporate form of industrial organization, was perhaps the first social mechanism to appear since the tortuous beginnings of industrial capitalism which seemed to represent a technique, a series of operational principles for solving any problem, that was free of "vested interests" and therefore intrinsically rational. For engineer reformers and technocratic dreamers in the first decades of the century, the economic dynamic which had created and revealed to the world the figure who could administer away the contradictions of "machine civilization" - the modern manager - emerged from the heart of capitalism itself. For corporatist fascists, the

planning procedures which had provided the techniques for laying down the base for a new economic order, the corporatist order, were the product of a process of self-transformation internal to the capitalist process itself. The capital requirements of the new production systems had placed a permanent barrier between financial and technological interests in the operation of the modern economy, and created the conditions for the disinterested technical manager to rise to rise to dominance in the social order.

In exploring the process whereby such generic tensions in modern industrial capitalism emerged to help inform the formalized political concept of corporatism, the thesis deals with (in addition to the history of inappropriate development in Italian economic development): failures on a technical level to integrate the industrial structure and lay down the bases for a wider ranging market for industrial products, through, for example, the construction of an integrated industrial power network; the structural changes brought about by the First World War in the relationship between industry and the state, which were important to corporatist ideas about planning later on. The section based on archival material and which deals with reform of the administration of the state is intended to suggest a mechanism of transfer of managerial ideas from the world of industry to the discourse of the political authorities. The primary sources for the thesis are however contemporary engineering journals, a surprisingly neglected but exceedingly rich source for investigating the contradictions which led to the formalization of the corporatist model. It was here that the connections were most explicity drawn between the interdependent functions of technology, business, administrative and political organization, and where the challenge of reform was most clearly articulated. Among Italian writers known to me, only Giulio

Sapelli [11] and Giorgio Pedrocco [12] have considered some of this literature, though not with the aim of investigating the discourse of engineers as political ideology, and to identify its historical specificity. Among English language writers, as far as I am aware, there has been no research done with this historical material.

In large part, I have tried to let the engineers speak for themselves. Like scientific management itself, the social reform discourse of corporatists and engineers did not question its socially neutral and unassailably rational essence. Indeed, the banner of functional competence by which scientific management was legitimized, and which found political expression in the 1920s in Italy in the discourse of corporatist social engineers, left little room for criticism on its own terms. Following the machine model, the common terminus of scientific management and corporatist fascism was the transcending of the problem of power by deployment of a basic engineering concept: to predetermine the overall function of the machine or social "organism" by rigidly constraining the options of its parts. As a closed and self-referential discourse, such modes of reasoning are structured to disarm criticism. It is at such a point in critical analysis, as Herbert Marcuse pointed out, that

> the problem of "metalanguage" arises; the terms which analyze the meaning of certain terms must be other than, or distinguishable from the latter. They must be more and other than mere synonyms which still belong to the same (immediate) universe of discourse. But if this metalanguage is really to break through the totalitarian scope of the established universe of discourse, in which the different dimensions of language are integrated and assimilated, it must be capable of denoting the societal processes which have determined and "closed" the established universe of discourse. Consequently, it cannot be a technical metalanguage, constructed mainly with a view of semantic or logical clarity. The desideratum is rather to make the established language itself speak what it conceals or excludes, for what is to be revealed and denounced is operative <u>within</u>

> the universe of ordinary discourse and action, and the prevailing language contains the metalanguage. [13]

This is the identical epistemological point, arrived at after quite a different form of analysis, made by Douglas Hofstadter when he concluded that "the process by which we decide what is valid or what is true is an art; and that it relies as deeply on a sense of beauty and simplicity as it does on rock-solid principles of logic or reasoning or anything else which can be objectively formalised." [14] Such an approach has informed my own perspective on presenting the closed discourse of the engineering and corporatist ideology examined in the thesis.

Basing itself largely on the reformist critique of engineers, and therefore being substantially limited to intellectual history - albeit with a materialist methodology - the thesis can perhaps lay greater claim to descriptive correlation than for having articulated the causal historical relationships called for by James Gregor:

> We know...almost nothing definitive concerning the decision making processes governing fascist policies. For all the work on the relationship between the leaders of Italian industry and Mussolini, there is actually very little evidence that would define the conditions governing the exercise of power in the Fascist state. [15]

The historical analysis required to satisfy such an invocation would need

> to be derived not on the basis of abstracted empiricist theories of pluralism, nor ideologically based assumptions of class rule, but on a historical and materialist analysis of...the changing political structures which correspond to different stages of capitalist development. [16]

If some of the analytical categories used in the thesis would help to inform such an analysis of corporatist reformism in 1920s Italy, it has achieved its aim. The more specific ambition of my research has been to try to contribute to a conception of one of the most frequently discussed, but hazily defined, political phenomenon

of our century, through attempting to link it with perhaps one of the most potent ideologies ever conceived - scientific management.

Chapter I: The Contradictions of Development and the Formation of Engineering Ideology

Chapter I. Introduction

> The modern conservative stands above any particular form of government. He could develop and work equally well, without changing political program, in a monarchy or in a republic. This feature of the modern conservative has never been so evident than in the past few years...in the face of a question which demands resolution; a question that, because it is the key to the future of modern society, has taken the name of "the social question". 1

In the social program of Italian corporatist reformers, technological renovation of the industrial structure, direct state control over the labour market, centralization and concentration in the organization of industry, and an intense campaign for economic independence through development of indigenous resources, were never dissociated in planning for change. Re-casting the productive base of the economy through the mobilization of science for industry, authoritarian intervention by the state in the functional reorganization of social classes, and a drive for national economic liberation (to be realized by carrying forward the first two programs) formed the touchstones of corporativist reform in the 1920s.

Such a combination of components was not, however, a fascist invention. Rather it was deeply rooted in the Italian experience of economic development, the most essential feature of which was scarcity - of capital, social infrastructure and raw materials, viewed as functions of the existing technological options. Scarcity naturally produces a search for substitutes, and in the late 19th century the substitute to which recourse was continually made in assisting development was protectionism, combined with the transfer of technology. Not surprisingly, during the period of most rapid development of the industrial structure in Italy, support for protectionism and enthusiasm for industrialization so often were positions represented by the same individuals.

With the appearance of new electrical and chemical technologies at the end of the century, new promise seemed to be held out, a new beginning appeared to be on offer, which would allow Italy to participate as an equal in the marketplace. The transformation of matter made possible by new ways of producing commodities would be the means of passage into a new social order. Factors of production, being only a function of the prevailing technology, promised to undergo a value transformation, and the concepts of dearth and scarcity as previously understood would become obsolete. If Italy had no coal or iron, she could have hydroelectric power and synthetic materials industries. To effect such a change in the means of producing commodities, however, clearly involved nothing less than the overhaul of the entire social structure - capital markets, transportation and communication networks, the education system, laws relating to the fiscal order, and the organization and mobility of human labour. Because of the central role that science would have to play in the creation of wealth in a nation lacking the conventional resources of an industrial economy, technical reform and a conservative social revolution were viewed as equally necessary components of the reform program formulated by a small number of influential figures in the closing years of the last century. In looking at the lineage of such a social program, the figure of Giuseppe Colombo forms an enormous presence over the totality, and this chapter, designed to set the scene for much of the thesis as a whole, will begin with consideration of his work. Through his successful efforts as an entrepreneur in bringing the Edison lighting system to Milan; through his work as president of Milan Polytechnic, where most of the peninsula's most powerful business and corporate leaders would be educated in Colombo's courses on industrial technology; and through his interventions as conservative parliamentarian, Colombo's career represents the most significant example in industrializing Italy of the fusion of scientific and

engineering reformism, entrepreneurial acumen and political authoritarianism during the most rapid period of Italian industrialization, and assessment of his work is a logical starting point for the present investigation.

To more fully grasp the nature and conception of industrial reformism as conceived by engineers such as Colombo, however, a further step on to a different level of analysis needs to be taken. The actual substance of Colombo's approach to mechanical technology therefore, and the engineering methodology he transmitted to the nascent class of industrialists who were his students in Milan, will also be considered in this chapter. In this regard, the work of Colombo's contemporary and founder of kinematic theory, the German engineer Franz Reuleux, will be analyzed in some detail. Indeed, one of the fundamental goals of this thesis is to encourage a mode of viewing the development of the theory and practice of social organization in Italy in the early part of this century which integrates phenomena operating at very "high" and very "low" levels of society. Since, viewed at a sufficiently abstract level, a machine metaphor for the social world was an important part of the model which came to dominate programs for social reform in the period considered, it is important to consider in detail precisely what was understood to be the essential features of a "machine", which may help to explain why its metaphorical value was so powerful in the specific historical context of early 20th century Italy.

The chapter then considers how the organizational metaphor provided by late 19th century engineering theory emerged simultaneously in the articulation of two historically parallel discourses: the administrative theorizing of reformists like Henri Fayol in France, and the social programs of corporatist reformers such as the fascist minister of Corporations Giuseppe Bottai, though among whom were also many engineers.

My suggestion here is not that there is a rigid and identifiable chain of causation that runs from the theorizing of engineer-managers to the reformist discourse of corporatists such as Bottai. It is doubtful perhaps if such an historiographic exercise would be possible; it is, in any case, not the ambition of this study. Rather, having noted that in a particular historical moment corporatist theoreticians and engineer reformers appeared to be talking the same language - sometimes, indeed, to each other - the aim here will be merely to try and identify the historical conditions which may have brought this phenomenon about. Further on in the thesis some specific features of Italian society in the period will be highlighted, which I believe may suggest a possible explanation for this apparent merging of perspectives.

In addition, I have felt it important to emphasize that although the discourse analyzed here assumed qualitatively different forms and its nature profoundly varied according to historical circumstances in a given environment (factor prices and factor availability, class alignments and institutional arrangements), it was nevertheless conceived as a generic comment on industrial capitalism. Given this feature of the corporatist/technocratic ideology, the chapter also looks at the work of the American economist Thorstein Veblen, who made perhaps the most coherent contemporary analysis of the contradictions of "machine civilization", which was the problematic within which corporatist reasoning was articulated. Again, the historical specificity of the Italian case will be analyzed in detail in the chapters to follow. In this section, my primary aim is to draw out the connections between engineering modelling, administrative theorizing and the corporatist conception of social organization, and that the tensions responsible for transforming engineering methodology into political and organizational theory were a generic feature of capitalist societies undergoing the late nineteenth century revolution in social production.

Taken together, I have tried in this chapter to present the outlines of an argument that would encourage a view of corporatist reform as lying very much within the analytical realm, and the tangled web of contradictions, embraced in the engineering educator George F. Swain's statement that "the engineer is a businessman, for engineering is business and business is engineering." [2] From a more critical perspective, David Noble articulated the same essential, irresolvable problem:

> Because they embodied the union of business with science, engineers naturally sought, in their technical work, to resolve the tension between the dictates of the capitalist system and the social potentials implicit in technical development. For them, technology was exclusively a means of strengthening capitalism, rather than something which pointed beyond it. And since they pretty much defined what form technological advance would take, technology tended to evolve in close conformity with capitalist requirements...In all their undertakings they worked to counter the forces of instability inherent in the evolving capitalist economy, to ensure the continued prosperity of corporate industry and to promote and regulate the scientific and technological progress upon which such prosperity depended...In a sober and scientific manner they strove to analyze, rationalize, systemize, and coordinate the entire "social mechanism", to translate haphazard, uncertain, and disruptive social forces into manageable problems for efficient administration. [3]

In a very real sense, this chapter will argue, technocratic corporatist reform was a product of such a perceived contradiction/identity between engineering and business; and by trying to conceive a model of society based on the technological component of dynamic capitalism, such reform theory ended by reproducing the contradictions of the system which had given rise to it.

Giuseppe Colombo and the Articulation of the Problem

In March 1924, at the inauguration ceremony which opened the new headquarters of the Edison company in Milan, a sculptured bust of Giuseppe Colombo, made especially for the occasion, was revealed to honour the event This was accompanied by a panegyric by O.M. Corbino, at the time minister o National Economy, physicist, industrial reformer and entrepreneur in the

electrical industry. "History will tell," Corbino stated,

> whether Colombo was wrong in trying to prevent the nation's progress from being blocked by the charlatanry of those who... proclaim, in the name of freedom, the right of minorities to sabotage the country. But on one point the judgement of history can be securely anticipated: that the work of Giuseppe Colombo, protagonist and patron of our industrial development, has contributed much more to the well-being of the proletariat than all the declamations of the apostles of class revenge, and the provocations of those who advocate permanent conflict between workers and industrialists. [4]

Born in Milan in 1836, Colombo attended the pretigious Sant'Alessandro school, which was followed by studies in mathematics in Pavia. Graduating in 1857, he returned to Milan to teach at the Società d'incoraggiamento d'arti e mestieri, where "he came into contact with the aristocratic and entrepreneurial world of Lombardy that had promoted the founding of the school".[5] This educational institute had been established in 1838 around th figure of Giorgio Mylius, to study and improve manufacturing techniques and promote the diffusion of a"technological culture" in Italy.[6] The Società functioned as a forum for like minded enthusiasts for renovation of the Italian industrial structure, advocating a more rigorous scientific base to production, based on the best foreign practices but ever conscious of the need to find alternative means to lay down a manufacturing base to the Italian economy that was not merely a strict copy of the British model - a model that assumed an abundance of combustible fuels and raw materials. To Colombo and similarly inclined contemporaries, such as his collegue at the Società d'incoraggiamento Carlo Cattaneo, Switzerland at least demonstrated the plausibility of the concept.

Everything, however, remained to be done. From 1856 Colombo began to teach himself machine design and mechanical technology, while working in the reformist ambiance of the Società. At that time there was nowhere in Italy such material could be studied formally - courses in mechanical desig and industrial technology simply did not yet exist. Colombo therefore set about inventing them himself. Industrial chemistry programs were soon on offer at the Società, as well as courses in descriptive geometry. Colombo himself taught courses in agricultural machinery design, sewing machines,

and heating and ventilation systems.[7] Colombo was also perhaps one of the first students and activists of industrialization in Italy to appreciate the declining importance of the English system of manufacturers, and the rising potential of German industry, particularly as regarded the importance of technical education, rigorously founded on the latest scientific and engineering techniques.

From the beginning Colombo was intensely sensitive to the business potential of recasting Italian industry on the basis of the material transformations made possible by organic chemistry and electrical power generation, an awareness that culminated in 1881 with his almost single handed success in bringing the Edison lighting system to Milan. Financed by the Banca Commerciale (of which Carlo Esterle, also of Edison, was a financial advisor) and Credito Italiano (of which Colombo was president from 1909 to his death in 1921), and having acquired the direct dynamo connection from the Edison representative E.G. Acheson in Paris, the Societa` generale italiana di elettricita` sistema Edison was constituted in January 1884.[8] With E. Rava presiding, the company's initial share capital totalled 3,000,000 lire, divided into 12,000 shares at 250 lire each. Also underwriting the formation were the Compagnie Continental, the Banca generale di Roma, Credito Lombardo, the Banca di Milano, the Banco di Roma and many private individuals, including the chemical entrepreneur Carlo Erba. Colombo himself was appointed chairman of the board, a position he held until 1891, when he left to become minister of Finance.

In preparing for the import of the technological package that was the Edison lighting and power generation system, Colombo had carefully studied the Edison works at Menlo Park, and had brought back J.W. Lieb to Italy as an advisor on construction of the San Radegonda central, the first of its kind in Europe.[9]

In the meantime, Colombo carried on with his activities as an industrial reformer, now "engaged" as well as an extremely important entrepreneurial figure in economic and technological development. Essential to creating more than an industrial dinosaur, with a miniscule brain and body slow to respond, the diffusion of a "technical culture" in the Italian middle class, and its institutionalization through tightened links between industry and research, were required. "The laboratory," Colombo wrote, "must always be ready to help industry respond to questions; and when one is dealing with industrial problems of the first order, (scientists must) examine and study them in collaboration with the industrialists themselves." [10]

Colombo's philosophy of salvaging Italy from industrial obscurity was a lesson not lost on some of his students at Milan Polytechnic, where Colombo had become Director in 1897, a position he would hold to the end of his life. Some of his students in Milan - G.B. Pirelli, Ettore Conti and Giacinto Motta of Edison, Giudo Semenza and Cesare Saldini, whose careers as engineer-reformers will be explored later in the thesis - were to become the most important figures in both Italian science-based industry and technical reform efforts in the 1920s.

Pirelli, who graduated from Milan in industrial engineering in 1870, was provided with a letter of introduction by Colombo on completion of his studies, to visit factories abroad and learn the key that made foreign industry so much more productive than the Italian. In a letter of May 1871 Colombo wrote to the future monopolist of rubber production in the peninsula:

> I believe that by going abroad you can import back to us a fragment of that industrial spirit that animates the foreigners. When you return here, eager to use what you have learned, I guarantee that you will find a way to utilize your expertise and knowledge. Here in Italy the industrial spirit is just beginning to form...the correct stimulation is all that is required to bring it out completely; a push from young people as yourself who come here and say: "abroad they do things in such and such a way; why can we not do it here as well? [11]

As Milan City Coucillor, president of Milan Polytechnic, chairman of the board of Italian Edison and conservative parliamentarian from 1886, Colombo was well placed to make such guarantees to promising young engineering graduates, eager to put into practice some of the reformist enthusiasm on which Colombo had weaned them in his courses on industrial technology.

From the perspective of subsequent conceptualizations of reform, the constellation of elements that made up Italian economic reformism would not significantly change from the time of its initial formulation in the 1880s, when Colombo first studied the Edison system at Menlo Park, and brought back to Milan the Edison technician and entrepreneur J.W. Lieb to install the first electrical lighting system in the peninsula. In a nation of recent political unification and little social and economic homogeneity, institutional order and a rigid conception of the principles of authority and hierarchy were still regarded as prerequisites of competitive industrial development. Science based industry was not only to promise emancipation from the heavy burden of an inappropriate industrial model, but from the time of their appearance in Italy, new forms of producing and transforming resources in production were regarded as the groundwork for a new concept of authority in the entire society. As Colombo himself pointed out in his endless struggle to convince contemporaries of the social and economic benefits of industrial science, large scale production systems based on massive energy consumption, besides immeasurably lowering production costs, also required "numerous working masses, having few needs, and easy to regiment." [12]

In practice, such a committment to industrialism at all costs, in the case of Colombo, took concrete form in , for example, his stance on the question of child labour in the parliamentary debates of the mid and late 1880s. In a speech made on the 21st of May, 1889, referring to a new law

regarding child labour and speaking specifically about the textile industry, Colombo asked the government

> to look carefully before applying a law like this, to make sure that the law itself would not be too much of a blow to the nation's industry...In the spinning mills the work is done by spinners and young women working together; if the working period of the women does not coincide with that of the spinners, it is clear that the work cannot be carried out. There would be no choice but to use two shifts of women, which, in an industry which is barely surviving, would remove that small margin of profit that is still just possible today. [13]

On a larger level, Colombo represented a strain of reform ideas on the "modernizing Right" which saw in the fact of industrialization itself a means to establish order in the society. Apart from the objective social structures that would necessarily evolve to complement changing forms of production, and that would by their nature serve to define relations of power in political society, the technical procedures that constituted the industrialization process itself would also serve to transform basic behavior patterns and attitudes of the people. Carlo Cattaneo, with whom Colombo worked closely during a large part of his professional life - Cattaneo was the founder of the journal Il Politecnico in 1839, and had worked with Colombo in the reformist atmosphere of the Società d'incoraggamento d'arti - spoke for many of collegues on the reforming Right, both in and outside of technical circles, when he insisted that science and technology, organized in industry, and through liberating men from old prejudices and vague social fantasies, was inherently liberatory, progressive and democratic. Science and industry thus formed an interlocking web of social forces that conspired to liberate men from the burden of uncertainty, and create a more ordered and rational world. [14] The industrial reformers from Lombardy did not appear to consider the possibility that economic and social development could move in opposite directions, the one advancing at the same rate as the other retrogressed. [15] As a consequence of the fact of underdevelopment, or inappropriate development and institutional chaos, the reforming zealots of late industrializatic

in Italy saw a rather more mono-directional path of causation, that lead more directly and unambiguously from changes in industrial organization to institutional transformation at all levels of society. If the institutional structure of society, and the perception of "truth" within it, were dynamic phenomena - functions of the existing level of material discovery which was continually overthrowing old assumptions - a characteristic of the industrialization-social reform discourse in Italy was that from the beginning it was firmly in the hands of the political Right.

Until the important but nonetheless solitary interventions of the Neopolitan socialist Francesco Nitti on questions of the role of the state in an industrializing economy - and more fundamental issues of the appropriate direction of technical change itself in an economy characterized by scarcity - Italian Marxism was never, during the period of most rapid growth, closely associated with the issue of economic development. Within leftist movements, there was no true committment to industrialization and economic development in general, and the proletariat was primarily conceived as the class of landless agricultural wage labourers. In part, Italian socialists defined their position negatively, by playing only a peripheral role in the pre-war debates on the correct road to development for Italy.[16] The field was thus left to authoritarian reformers such as Colombo, Michele Pantaleoni, Vilfredo Pareto, Riccardo Dalla Volta, Alessandro Rossi, Filippo Carli, Santi Romano, and others, whose political perspective defined the terms of the debate. By virtue of lack of participation by the political left, conceptualization of alternative models of economic development in general, and technological and institutional reform in particular, were left to evolve within the terms laid down by authoritarian reform schemes. Thus, empirical analysis of the possibilities for development in Italy, advocacy of applied research, "realistic" investigations of alternative models to the north European iron and coal precedent, and the function and reform of the state in relation to the

practical possiblities that emerged, became permanently associated with representatives of the established order.

What was true for Italian Marxism also held true for the liberal alternative. The position was well expressed by Carlo Francesco Ferraris, professor of Administration at the University of Pavia in the 1880s, and subsequently chancellor of the University of Padova:

> I respect the ingenious theories of the international division of labour, of comparative cost, of markets - abstractly true, but that correspond little to the historical conditions in which national and international economies develop. Technological progress is constantly changing these conditions... and can radically alter the economic structure of a country. 17

As against the flaccid sermons of the liberals and free traders, which would only have condemned Italy to further domination by foreign interests more well endowed with resources, the militant sociologists and technical reformers of Italian industrialization articulated a development program of protectionism, an activist and interventionist state, and advocacy of technical progress. The elements which composed the reform plan would force those whose political position was distributive rather than productivist to face the charge of lacking a sense of realism and context. Given different conditions, such as the militarization and politicization of society caused by the first world war, such accusations could easily break out of the limited world of polemical tracts on administrative and industrial reform, and be transferred into a pandemic calling into account of the political loyalties of those not supporting the model. The mechanism of transfer of such a polemic would be the mobilization of the "organic" intellectuals of government statistical bureaux, technicians in daily contact with production, functionaries of economic ministries, and so on.

As regarded protectionism, in the age before organized science, in the form of engineering, had revealed alternatives to the dependent status inherent in following the British model, direct intervention by the state in the form of tariff protection seemed the only means of establishing

any kind of manufacturing base to the economy at all. Although the policy pursued of protecting the iron and steel industries ultimately created a debilitating intersectoral disequilibrium and blocked the development of a vigorous machine building sector in Italy,[18] it was logical that some of the most powerful spokesmen for nineteenth century industrial capitalism were simultaneously the most vocal advocates of protectionsim. Again Colombo was representative:

> Free competition is a great and fertile principle, and can be followed where industrial development has reached the point where imports need not be feared, and can be balanced (by exports). But until the country's industry has reached this level of development...protectionism, albeit limited, is not debilitating but necessary.[19]

In general, throughout the period of economic expansion before the first world war, the paradoxical situation prevailed of technical reformers being compelled to advocate, in some respects, the "anti-industrial" policy of protectionism, and this relationship between the state and private industrial capitalism gelled into the singular situation where technological zeal was combined with an expectation that the government would systematically intervene in business affairs to protect property arrangements, insure acceptable returns on capital investments, and guarantee markets for industrial products. "What makes Italy unique," Jon Cohen wrote, "is the extent to which these groups relied on governmental favors, their economic and political power, and their unwillingness to compromise."[20] An enduring feature of the Italian economic system, post-war overcapitalization problems and tight markets served only to further ossify the tried and tested system of industrial clientelism. The point was made forcibly by Giovanni Silvestri, president of the Confederation of Industry, in March 1920. Referring to free trade theorists, Silvestri wrote: "Ideas, only ideas, that if confronted with reality, if put to the test, do not respond to real problems...if this theory were to be rigidly applied in Italy, all forms of producing manufactured goods would have to be entirely renounced."[21]

In the hands of reformers on the political right, the economic logic which underpinned the drive to recast the technical structure of industry, combined with a long standing relationship of interdependence between the industrial, political and social worlds, merged with relative facility to form an ideology of corporatist collaboration and conciliation. This ideology, however, would be varnished over a traditional configuration of "individualism, personalism, clientelism, and transformism," that, by the late 19th century, had lost "any casual and moralistic connotation, and become objective dimensions of political and social reality."[22]

Parallel with making recourse to the traditional expedient of tariff protection to secure a manufacturing base to the economy, conservative reformers could now play the card of science itself, practical reason, as their most potent ally. Together with, and in some cases in place of, protecting industries with precarious foundations, they would transform them through applied research. Although the problem remained the same, the terms of the possible solutions had undergone a qualitative change. In the post war period, reform, real reform that would not simply take Italy out of the German yoke and into the American one, would have to emerge from the dialectical process of the politicization of science and the scientization of politics, to be achieved through the active process of industrializing the culture as a whole. In full harmony with the traditional reform rhetoric of the zealots of industrialization, the state itself was to be transformed from a mere guardian of existing interests, into an active agent in the production and reproduction of new ones.

Carlo Francesco Ferraris, in his reflections on the science of administration and the function of the political authorities in economic development, had intuited and advocated the coordination and harmonization of public and private interests at the beginning of the new century:

> perhaps never before have material interests held such an important place in public life as they do today. Agriculture, manufacturing industry, commerce, communications - these are today responsible for the task of civilizing the world. The economic development of society must therefore be the principal concern of the state.[23]

The main features of this reformed and activist state, that it was the job of the science of administration to articulate, would include: laws to ensure freedom of movement for economic interests in the buying and selling of property and the determination of prices; organizing public bodies to coordinate the general conditions of production and exchange (insurance, weights and measures, money and credit, communications, the patent system, and interventions to correct periodic economic downturns); precisely defined roles and functions of government administration in individual branches of production (agriculture, forests, manufacturing, mines, fishing, commerce, colonies, etc.), from "the commercial point of view"; a policy on savings institutes, accident insuranc policy; and lastly, the state's role would have to be enlarged to include mediation of industrial relations between capital and labour. Specifically, this would involve promoting cooperation, regulating industrial training and labour contracts in both agriculture and manufacturing, and industrial arbitration procedures.[24] If such a model were neglected completely, one would simply be compelled to accept the consequences of "masses easily disposed to more disordered passions."[25]

Moving away from the level of the factory or industry, Giuseppe Colombo remained consistent in his reasoning in his meditations on the social function of political administration:

> the thesis that emerges in Colombo's discourse, was that the government was to play an active role in the area of industrial and social relations, with the double objective of favouring agreements between capital and labour (though assuming the hegemony of the first), and to guarantee security, stability, discipline and order. This would be achieved by removing the dangers of 'excessive' freedom...[26]

Taken as a whole, the guiding principle of conservative social and political reform, as distinct from but dependent upon corresponding industrial renovation, was neatly put by Vilfredo Pareto - who was aware of Colombo's reform efforts, and regarded him as a "man of talent and real value": "The state must start being judged according to criteria of its output as a production company. This is a very important idea which will see notable development in the age to come." [27]

With industry increasingly coming to be perceived by reformers like Colombo as the dominant force in modern life, so the models and methodology of its designers and innovators had to be refined for the job at hand. Since in Italy the process of constructing a reformist ideology based on a machine metaphor and industrial priorities for social organization begins with the work of Giuseppe Colombo, the section to follow will deal with the major contemporary theoretical innovation of the time in the field of mechanical engineering - Franz Reuleux' kinematic theory - which furnished Colombo and his students with a codified and static methodology for industrial design that they had, up until that time, been without.

As will be argued, however, for engineers and social reformers disillusioned with the traditional practices of political manoeuvring and financial speculation as determinants of social power, the construction of such theoretical models in the "hard sciences" represented much more than the mere articulation of principles for producing industrial commodities. Rather, it represented a system of organizational principles for the ordering of any complex series of phenomena which could, it was perceived, be applied in the indeterminate and uncertain sphere of social and political relations as well.

Mechanisms and Methodology: Franz Reuleux and the Theory of Machines

The theoretical basis of Colombo's approach to mechanical technology was the almost mystical conception of machine principles presented in the fundamentally important text in the history of modern mechanical engineering: Kinematics of Machinery. Outlines of a Theory of Machines, by the German engineer Franz Reuleux.[1] This enormous masterpiece of inductive analysis (a work of some 600 plus pages) appeared in German in 1875 and within a year was translated into Italian - by Giuseppe Colombo.

Before going on with an analysis of the text itself, a general observation should be made: the development of kinematics - or the study of mechanisms - as an independent discipline offers an important example of the invention of a type of theoretical science out of a technological fait accompli, one significant instance of the re-molding of modern science through its being "transplanted from its home in philosophy to technology."[2]

It is first important to emphasize, as indeed Reuleux himself did, that although he was the first to analyze and classify machines according to kinematic principles, these principles had in fact been utilized in the practice of machine design long before. His contribution was to abstract from the physical properties of mechanical relationships, and formulate construction principles based on theoretical laws which regulated and determined such relationships. Reuleux was perfectly aware that in isolating, identifying and classifying these laws under the name of kinematics he was doing little more than conceptualizing an already well established practice in machine design. "It is remarkable," he wrote, "that there is scarcely any

kinematic problem, scarcely any turning, however bold, in the theoretical propositions, for which we cannot find an example in practice. It must not, however, be considered that theory has only and always to limp behind practice, as is too often the case; it may rather be said to comprehend in itself all the mutual relations of the law which in their application constitute this practice." [3]

In making this intellectual contribution, Reuleux joined the ranks of such contemporary figures as Benjamin F. Isherwood, chief engineer of the United States Navy during the Civil War, and Robert Thurston, one of the founders of the American Society of Mechanical Engineers, in the late nineteenth century movement to "redefine 'science' in a way that brought it into closer correspondence with engineering science." [4] In the case of Reuleux, this meant introducing "into machine problems those intellectual operations with which science everywhere else pursues her investigations." [5]

Reuleux saw the originality of his theory in having identified what he considered to be the essential characteristic of a "machine", understood as a generic totality of mechanical relationships. His definition ran as follows:

> A machine is a combination of resistant bodies so arranged that by their means the mechanical forces of nature can be compelled to do work accompanied by certain determinate motions. [6]

The operationalist method he employed - later to become a staple of scientific procedure - he viewed as representing a new step in the conceptualization of machine design. In essence, this procedure involved making the abstract principle of integration of structure and function, form and content, itself part of the methodology of mechanical design. Put another way, "the concept" - in this case the kinematically designed machine - "is synonymous with the corresponding set of operations." [7] As Reuleux himself explained it:

> a machine consists solely of bodies which...correspond pair wise, reciprocally. These form the kinematic or mechanismal elements of the machine. [8]

Examples of such kinematic pairing would include the mechanical relationship of a shaft and bearing, or simply a screw and nut. A machine, therefore, had to be thought of in the abstract as consisting not of individual elements, but of pairs of elements, which interacted in a determinate way, depending on the limited movement allowed by their pairing together. This Reuleux called a kinematic link, and a kinematic chain was the result of the placing together of kinematic links in a mechanical series. [9] The motion created by such combinations of pairs could be multiplied indefinitely, just as the construction of pairs of elements was possible for any motion. [10] In the kinematic chain formed of pairs of elements, Reuleux observed, every two adjacent links had a definite relative motion. But if these two links were connected to a third, reciprocal and determinate motion could occur

> only if the chain be so arranged that every alteration in the position of a link relatively to the one next to it be accompanied by an alteration in the position of every other link relatively to the first. In a kinematic chain which possesses this peculiarity, each link has only one relative motion to each other link; if, that is to say, any relative motion occur in the chain, all the links are constrained to execute determinate relative motions. Such a kinematic chain I call a constrained close -or simply a closed - chain. [11]

If one link of such a chain were made stationary, Reuleux called it a "mechanism", [12] which in turn would be moved if a mechanical force were applied to one of its links so as to alter its position. "The effort thus applied," he summarized, "performs mechanical work which is accompanied by determinate motions; the whole, that is to say, is a machine." [13]

Reuleux believed that it was precisely the absence of such theorizing that made the process of mechanical invention slow, and accounted for specific design failures as well. Failures occured because the design in question "rested on a defiance of this principle, the destruction of the closure of the chain." [14]

Having made such an analysis, and identified and classified the abstract properties of a functioning machine, Reuleux went on to consider "the employment of living agents". Given the general and static character of his classifying procedures, it is perhaps not surprising that Reuleux' conclusion on the relationship between a "living" and non-living mechanism in producing mechanical work differed little from his prior analysis of kinematics within the machine itself. Illustrating the concept with the simple example of human labour being used, by means of a treadle, to drive a grindstone, Reuleux concluded: "the body of the worker becomes kinematically chained with the machine...always...we have the same union, by kinematic chaining, of the living mechanism with that of the machine." [15] The kinematic relationship of the operator with the machine was only an extension of the lower level relationship between the tool and the piece being worked by the tool: "In form changing machines the work piece is a part or the whole of a kinematic link, and is paired or chained with the tool by so arranging the latter that it itself changes the original form of the work-piece into that of the envelope corresponding to the motion in the pair or linkage employed." [16]

Structure and function, subject and object, form and content have been unified through the micro level workings of a network of mutually dependent and determinate relationships - the structure of the system defined its function, as its function in turn determined its structure. Micro and macro levels could act in perfect harmony to constrain and pre-determine the behavior of the total mechanism. And the means to realize such integration were to reproduce on ever larger levels a relationship of simple mechanical or physical determinism operating at the most basic and detailed level of the system.

As Reuleux himself viewed the book, its strongest points were in logic and philosophy, which no doubt explains its contemporary popularity with non-technical readers as well as engineers.[17] Although, in fact, his original analysis never went beyond the specific context of the kinematics of machines and their operators, at the root of his presentation of mechanical functions lay an idea about the interplay between structure and function in any operational system that (economic and social variables entirely aside at this point) helped underpin the subsequent conceptualization of the modern engineer's contribution to 20th century social theory: administrative modelling, industrial organization theory and, at a "higher" level of analysis, their contribution also found echo in the technocratic and functionalist notions of social organization advocated by corporatists in fascist Italy.

As might be expected, Reuleux' formulation of the science of kinematics in this way, his implicit stepping back from the lowest level functioning of machines and attempt to view the whole as a physical representation of a series of theoretical principles, was combined with a social philosophy of engineers and technology which his Italian contemporary and translator Colombo shared. As with Colombo, the refinement of the theoretical basis of modern engineering went hand in hand with a drive for industrial and social reform , which placed at the centre of debate the role of

organized engineering - industry - in the creation of a new model for society. Both men could be said to represent a new figure, both in the history of engineering and in social history: the engineer-reformer, who, having helped recast and re-invent new ways of doing science (by making it conform more closely to engineering practice) instinctively felt that in codifying abstract principles to represent man-made objects, lay a key to modelling social organization that promised to liberate human affairs from irrationality and uncertainty. It was in parallel with such a form of analysis that certain functional notions about organization in general were conceived, and frozen in the axioms of modern administrative theory, industrial management strategies, and that finally found themselves reflected in the corporatist vision of a stable social order.

In the following two sections, an attempt will be made to provide an analytical framework which would serve to unify these diverse elements, and suggest a conceptual paradigm for helping to understand corporatist reformism in Italy of the 1920s. As indicated in the introduction to this chapter, for the moment attention will be concentrated on looking at the generic tensions in late industrial capitalism as perceived by contemporaries, which in part prompted the speculation of the reformers considered in this paper.

Following these two sections, the remainder of the thesis will be concerned with analyzing the precise historical conditions and system of industrial organization prevailing in Italy both during and immediately after World War I, in an effort to highlight and explain the historical specificity of the Italian corporatist model.

Machines, Managers and Corporatism. Overview of a Reformist Ideology in Fascist Italy

> The need to plan and calculate exactly within the enterprise, determined by the reduction in the turn-over time of fixed capital, creates the technical tools and interest for a much more precise registration of economic data, which can also be applied to the overall economy.
>
> - Ernest Mandel
> Late Capitalism
> (London, 1972, p. 237)

At the Second International Congress of Administrative Science in Brussels in 1923, the industrial manager and founder of administrative theory read a paper entitled "The Administrative Theory in the State". [1] With a successful career in management and a commission from the French government to reorganize the postal administration behind him, Henri Fayol summarized his method for the participants of the congress:

> to organize is to define and set up the general structure of the enterprise with reference to its objective, its means of operation and its future course as determined by planning. It is to conceive and create the structures of all the services that make up the enterprise, with reference to the particular function that each service must fulfill...It is to ensure an exact division of administrative work by endowing the enterprise with only those attributes considered essential, and by careful determination of the sphere of operations of each of them. [2]

In such statements - explicitly intended as universally valid propositions for organizing any complex system - Fayol was expressing both a methodology that had, in part, grown out of the late 19th century theorization of engineering science, and the practice and procedures of industrial management itself, as they had evolved in step with the articulation of engineering principles. For men such as Fayol, the creation of modern engineering had also furnished the essential tools for the organization of any functional series of phenomena, including the ordering of the modern administrative state in industrial capitalism.

Such a vast reform conception had begun before the first world war,

as an effort to provide a codified managerial doctrine to correspond to the engineer's new function in production. [3] Fayol's aim was to fill the gap left by the absence of a theory of administration, and "to establish in which proportions technical and administrative knowledge are important in the various levels of industrial hierarchy." [4] Taking the notion of "staff" from the military, Fayol's conclusion was essentially that the higher one goes in an administrative hierarchy, the less precise technical information is required for the efficient execution of duties, and the more administrative skills and training are necessary. "In any type of firm," he explained, "the essential capacity of lower level hierarchies is professional...and that of higher level personnel is the managerial capacity." [5] Fayol's major innovation, however, was "to detach himself from the narrow perspective of the firm, and affirm the validity of his ideas for any type of social organization and, in particular, for the organization of the state." [6]

The principle of "unity of command" - "only one boss and only one plan for a totality of operations that aim at a single goal" [7] - Fayol regarded as a universally efficacious managerial axiom. In the organization of a political state the networks of communications and hierarchical structures were simply much more complex than in an industrial operation. Successful application of the notion of the subordination of particular to general interests was, more specifically, one of the greatest challenges:

> This principle recalls that in the firm the interests of an individual or a group of individuals must not prevail over those of the company. Similarly, the interests of the family must have precedence over those of its individual members, and the interests of the state must have primacy over those of an individual citizen or group of citizens...There are always present two interests of a different nature, but of equal importance, and one must try to reconcile them. This is one of the greatest problems of management. [8]

The important point was that, though of a slightly different nature, political management was nonetheless management, and political problems had to be considered managerial ones:

> In the state the general interest is so complex, so vast, so distant, that it is not easy to assign it a precise form. The leader acts as a kind of myth for the mass of functionaries. If (the administrative structure) is not continually held together by higher authority, the general interest is weakened... and each service tends to feel an end in itself...It is generally thought that fear of responsibility is the principal cause (of this weakness). I fear, rather, that it is the insufficient ability of management. [9]

Part of this "insufficiency" lay in the simple refusal to see the importance of organizational procedures in technology and industry for the rational ordering of the social world:

> Everyone knows the formula for (organization) of the material world: a place for everything and everything in its place. The formula for the social order is identical: a place for everyone and everyone in his place. [10]

The necessary precondition for such a state of managerial grace was "union of personnel" - the harmonization of conflicting interests to avoid a "misinterpretation" of the principle of divide and rule, and dealing with the "abuse of written communications". [11] Both the aim and result of proper coordination would be an overall "plan of action", which in turn would help to define and reinforce the harmonization of the functional components which composed the plan:

> The maxim "to govern is to plan" gives an idea of the importance attributed to planning in the world of business...The plan of action is a kind of picture of the future. [12]

Fayol emphasized, however, that "a well studied plan cannot exist normally without a plan of organization, command coordination and control. This element of management influences all the others." [13]

In the efficient organization of a political state, meeting efficiency criteria demanded primarily ministerial expertise in the material at hand, and centralization of authority and decision making in the person of the minister himself. For Fayol, political instability was in essence caused

by violation of this principle - similar to Reuleux' idea of the "breaking of the kinematic chain" in explaining design failures in machines - which appeared to be an inherent feature of the political process itself: "politics" determined that ministers were simply changed too often, denying them the time to acquire the necessary expertise to make rational decisions about the running of their department. [14] The answer involved "linking the minister to his work". [15] This meant ensuring ministerial competence in the material at hand, keeping him in his job longer than normally permitted by "politics", and centralizing authority in the person of the minister himself to give consistent direction and cohesion to the work of the political authority. For Fayol, the structure of any hierarchical organization had the characteristics of a machine, in that the overall "impulse" was provided by the "boss", and "the parts of which are linked and move together towards the same goal." [16] The important point was that the intermediate "cogwheels" should be coordinated in such a way to reinforce the power to act and the authority of the "boss". [17] "The centrifugal authorities prevail," Fayol summarized, "only when the central force is weakened." [18]

In the immediate post-war period, when Fayol carried out his commissioned investigation for reform of the French postal system, he concluded by emphasizing a new efficiency criterion for political reform: as long as the state managed the communication services, they could never be organized according to the same principles which ensured prosperity in a private firm. [19] Concluding with a reform concept that would also emerge in the prescriptions for economic and institutional change of the Italian corporatists, Fayol suggested that services of an "industrial" character such as the post office should be handed over to management by private industry, while maintaining the overall authority of the state to monitor the service and determine goals and strategy. [20]

In Italy, Fayol's findings in L'incapacite industrielle de l'Etat were immediately reviewed in the electrical engineering journal L'Elettrotecnica, whose anonymous contributor commented that "this work will be particularly interesting for all those (and nowadays there are many) concerned with similar administrative problems, the importance of which in modern industrial life is becoming more evident every day." [21]

In a similar manner to Fayol, and reflecting the same methodological assumptions, the FIAT engineer Mario Fossati (educated at Turin Polytechnic under Giuseppe Colombo's former student in Milan and majority shareholder in the telephone corporation SIP, Giangiacomo Ponti) began his 1928 study of The Engineer's Function in the Application of Scientific Management with the concept of determinism as embodied in Reuleux' kinematic principles. [22] As one could dissociate parts that form kinematic linkages in machine construction and thus analyze them in isolation, so it was possible to do so with any functionally ordered construction. That this principle of determinism in machine design was extended to the field of economics and labour management, Fossati goes on to explain, was one of Frederick Taylor's most important achievements. [23] From here, though the rhetoric flowered slightly, Fossati passed with facility to commenting on yet a higher level of managerial thinking - the organization of the political state. He encouraged fellow engineers to look to the example of the fascist state, which had implemented the first applications of scientific management in the administration of the ministries. Italy, he claimed, was truly in the vanguard of the "organizational movement", in as much as the corporatist plan for economic reform was an integral part of a much vaster program for social renovation, "by the will of the Man who rules the nation's destiny with a sure hand," to coordinate and harmonize all social activity - both individual and collective - "in conformity with the pulsating rhythm of the new national life." [24]

For the most part, the "new national life" appeared to find an amenable audience in the engineering profession, and seemed to correspond well, at least in its stated objectives, with attitudes and preconceptions that the day to day technical and administrative work of the profession carried with it. A particularly important aspect of this work regarded the presupposition of "order" in the efficient execution of managerial duties. As the engineer Carlo Taranto explained in 1929, scientific management was something of an irrelevance when he began talking about it years earlier since

> the state of disorder prevailing in the country would not have easily permitted the application of the system, which presupposes a stable and ordered environment, an environment in which discipline reigns. This is the essential element in achieving collaboration between those who command and those who obey.
>
> Today, however, the government has imposed such a rhythm of activity and sense of discipline on the life of our country, that one can now speak of scientific management, not as something abstract or utopian, but as a source of greater possible well-being for everyone. [25]

For these engineers, to understand the theoretical principles and "philosophical" methodology of industrial design was a necessary (though perhaps not sufficient, as Fayol believed) base from which to proceed to the organization of inputs in both administrative and political work - given, that is, a state of undisturbed order between "those who command and those who obey." From the offices of FIAT's management Mario Fassio elaborated:

> To administer means to govern resources. It is impossible to govern well (either a company or a state, intended as a large firm) without knowing the interlocking mechanisms and administrative techniques...The principles which regulate the healthy, normal life of a company are no different from those which regulate social, civil, economic and spiritual life... [26]

Such modes of reasoning (typical perhaps of reformist spokesmen for the technical profession everywhere) could perhaps be regarded as little more than professional flag-waving by the technical intelligentsia, had they not emerged at another level of social comment in inter-war Italy. Speaking to the Fascist Association of Industrial Managers

in Rome in 1928, minister of Corporations Giuseppe Bottai assured his audience that

> the figure of the manager is particularly significant in the corporative organization of production...one could say that a kind of human trinity presides over the organization of production:-the entrepreneur, the manager and the worker. In this trinity the manager mediates the other two social categories, as in the conceptual trinity - capital, technology and labour - technology mediates the two social functions... in the industrial manager...the spirit of the Corporation is realized in practice. [27]

From his intrinsic role as mediator and integrator of the traditionally contending camps of capital and labour, through his position as the active subject in the design and organization of the means of production, the engineer-manager's function could be institutionalized at the level of political organization to effect a merging of the divided worlds of politics and economics. It was the engineer-manager who was the truly heroic figure and model builder of twentieth century social organization. "Professional individualism is finished, dethroned," Bottai stated to a national congress of engineers in Naples in 1927: "The professional super-man returns among the mass of workers to organize and manage them." [28]

The ideology thus formulated was based on a perception of new features of dynamic, technologically driven capitalism. Since the time of the war, Bottai explained, competitive pressures in industrial capitalism had been given a radical new push by changes in the means and organization of production. The major generic components of change were the mechanization of agriculture; the division of ownership and management and industrial concentration; the domination of industrial capital; the socialization of private interests; and "what American economists call technological unemployment". [29] Though injecting a powerful new stimulus into the production of wealth and commodities in industrial society, technological change was a mixed blessing. The competitive tensions that had been accentuated, not transformed, by technology determined that new methods

were applied "without regard to the higher interest of the collective."[30] For the corporatist Bottai, the new social configuration that emerged suggested, above all, a new conception of the state in economic organization:

> That which characterises the world today is struggle; not, however, between bosses and workers, but between the capitalists themselves and between fellow workers in competing categories of production. That is, the struggle has lost the strictly social character that it had when the great mass movements of our time began, and has acquired more characteristics of an economic struggle...Fascist order does not mean simply political tranquility; it requires economic stability as well. It is the function of the corporatist state to realize this stability.[31]

The responsibility of the corporations operating in Bottai's ministry was to research all "points of contact" in the modern economic order (e.g., legislation on industrial property, reform of labour laws, corporation taxes, industrial accident insurance schemes and so on) and oversee the organization of production at a national level to the end of eliminating "artificial" antagonisms (lauded by liberal economic thinking) and create a unified national economy.[32]

The same mechanisms and corporatist tendencies that fragmented economic society could, however, be turned around and used to re-construct a stable and unified social order. The model would come from the organizing potential inherent in the structure of the modern industrial corporation itself:

> The collaborative postulate, the pre-eminence of collective goals...appear continuously in the life of organization... the industrial manager (must be) responsible to the state as regards production.[33]

Corresponding with the industrial manager's role in the factory, "the responsibility of the public authorities must remain of an integrating and coordinating nature".[34]

By the early 1930s, the ideological conception of the corporatist state as being the institutional expression of the managerial function was dealt with as a truism of corporatist reformism. In 1933 Raffaele Numeroso, a lawyer working for the comune of Naples, confidently stated

that

> when one speaks of the Corporation, of the corporatist state, the words and concepts of management continually appear: discipline, economic order, control, stable organization of production inputs, the coordination of economic and political interests. What are these words, these concepts, if not an expression of scientific management? [35]

The rationalization of industrial processes and the reconstitution of the Italian state were interdependent parts of a unified reform package, and the discourse of industrial management provided the bridge linking them together:

> rationalization is an urgent and immediate problem, particularly in Italy, because of its intimate relationship with the profound transformation... that is being carried out in the economic, productive, social and political constitution of the Italian state - in relation, that is, with the Corporation, with the corporatist state... [36]

If such claims were no more than self-serving apologetics or the fantasies of marginalized social reformers, their pursuasive power as the dominant reformist discourse in much of Europe, as well as Italy, was remarkably cogent. In Geneva, Albert Thomas - technocrat, minister of armaments in France during the war and director of the International Labour Office - passed the ultimate stamp of "disinterested" approval on the vast social and economic experiment being undertaken south of the Alps:

> The most important of these experiences (in social and economic reform) is without doubt the law that created the Corporations in Italy...The new system has the goal not only to carry economic efficiency to the highest level...but to distribute the revenue of industry in a manner more compliant with social interests... [37]

From the engineers point of view during fascism - a profession congenitally obsessed with the question of social status - a political discourse which appeared to place them at the centre of social dynamics could not but be very favourably received. At the May 1931 congress of engineers, at which minister of Corporations Bottai was present, president of the congress and electrical engineer Ulisse Del Bufalo spoke up for his collegues:

> The Ministry of Corporations brings together all the productive activity carried out in the country, and regiments and disciplines all categories of mental and manual labour. All active elements of labour, technology and capital are incorporated into the Ministry. This is precisely the field in which the engineer operates. Just as the Ministry of Corporations is organized to effect harmony...between the three forces - capital, technology and labour - so the engineer...is often the protagonist of this ardous task - a task that seemed insoluble, but that fascism was able to resolve with a new idea that the world first derided, then studied, and is now trying to copy...in corporatism...is reflected the engineer's normal working procedures - that is, to realize maximum output with minimum means.
>
> Because of his nature, the engineer...always keeps his distance from politics. Indeed, his way of thinking does not tolerate uncoordinated and chaotic individual forces, not subject to any discipline, disordered and contrasting. Such a situation is too remote from his precise, efficient and economic mentality.
>
> For these reasons, he found himself in full and perfect agreement with the fascist conception. Engineers are, in fact, precisely those most needed by Il Duce...It is these qualities which explain why today there are many engineers in command positions in politics and administration, as political secretaries, podestà, or even prefects. 38

In reality, and despite the rhetoric and political claims of Del Bufalo in this statement, only in the Chamber of Deputies did the engineers constitute more than merely nominal presence. And despite the

technocratic noises coming from both the profession itself and the Ministry of Corporations, engineers were never anything more than "footmen of the chariot of state, not chauffeurs".[39]

At the institutional level, the question of the political neutrality of the "disinterested" engineer-manager was summarily resolved in July 1926, when the Industrial Managers Association was both created as part of the reform which was to legislate the corporatist state into existence, and immediately incorporated into the employers' federation, the CGI. The reason for this, as Bruno Biagi, undersecretary of state for the Corporations, explained, was that the industrial manager "has relations of very close solidarity with the functions of the employer."[40] "You can and must be," Bottai declared to a gathering of industrial managers in 1929,

> intelligent collaborators of the industrialists. You must carry to the industrialists - who are duty bound to study the new systems (of rationalization) - the fruit of your daily experience, matured in contact with workers and staff...This, in my view, is the principal task of the fascist manager.[41]

The position of the managers themselves was expressed by their representative Giuseppe Ceccarelli before the National Council of Corporations in 1931:

> We consider it correct procedure to include our National Association in the Confederation of Industry...within the firm the situation of the manager is only as favourable as is his strict collaboration with the owner, from whom the manager's authority and power to command are derived. Placing the manager in the same syndical category as the employer, therefore, conforms to the reality of production.[42]

In institutionalizing the class of "professional supermen" at the flank of the employers' organization - idealized by the corporatists and of course the "supermen" themselves as the socially neutral prime movers in the nascent corporatist economy - fascist practice ensured that the corporatist state - the "inevitable" consequence of technologically driven, monopoly capitalism - would be stillborn. The lawyer and analyst of corporatism Ferruccio Pergolesi noted the contradiction in 1935.

"In practice," Pergolesi observed, "industrial managers are effectively impeded from carrying out their function of 'corporatist mediation'... in part because of the diffidence of workers, who generally tend to associate managers with employers and proprietors; and because of the political representation that the law has accorded to managers, which includes them in the ranks of the employers." [43]

The contradictions and tensions of competitive capitalism which defeated the corporatist conception from the start, however, only served to further fuel the conception as ideology. The contradictions between theory and practice as they emerged in "corporatist" Italy illustrate well Marx' notion of ideology that "inversions in consciousness necessarily correspond with inversions in reality...Ideology is to do with those ideas which express practice inadequately. The reason for this is not a faulty cognitive process but the limitations of practice itself." [44] As Marx expressed it: "if the conscious expression of the real relations of these individuals is illusory, if in their imagination they turn reality upside down, then this in its turn is the result of their limited material mode of activity and their limited social relations arising from it." [45] For engineer-reformers and corporatist theoreticians, their "limited material mode of activity" - imposing insuperable obstacles to their effective capacity to reform society - was inversely proportional to the ambitions of their prescriptions for social transformation. The managerial model of social reform could never be anything more than a dismal failure as a guideline to policy, because it was never more than "a solution at the level of social consciousness to contradictions which (had) not been solved in practice." [46] As ideology, however, its very formulation defined its real function in society:

> That ideology can only serve the interests of the dominant class is the objective result of the fact that the negation or concealment of contradictions plays a major role in the

> reproduction of those contradictions: it is only through the reproduction of contradictions that the ruling class can reproduce itself as the ruling class...So the role of ideology is not defined by its class origin but by the objective concealment of contradictions. This is achieved by trying to reconstitute in consciousness a world of unity and cohesion. [47]

For the moment, I would like to emphasize the importance of abstracting from the specific context - corporatist Italy - in which these contradictions took such extreme form, and view them analytically rather than geographically as both cause and effect of micro level changes in the world of production. These generic changes - the rise of science-based industry and its institutional expression, the integrated corporation - served to introduce into modern economic organization both the engineer-manager, whose function seemed to embody the ancient dream of endowing power with an indisputably rational base, and the modern corporate form, which forever seemed to contradict and belie the promises of a rational social order. In the early period of science based corporate production, wherever it appeared, the power of a reformist discourse which promised rationality in a world plagued by contradictions should not be underplayed. The sources of some of these contradictions in the sphere of capitalist production, and the pressures which led reformers to articulate the discourse which appeared to promise liberation from these contradictions, will be analyzed in the next section, which will close the theme of this first chapter.

Levels of Rationality and Chaos in Corporate Production

> In modern management, these engineers who had been trained in science and weaned upon large-scale corporate enterprise fused the imperatives of corporate capitalism and scientific technology into a formal system. Representing a shift in engineering focus from the natural to the social realm, from productive forces to social relations, modern management constituted a deliberate attempt to ease the tension between the two, making both fit within the confines of corporate society. Moreover, as these engineers became managers in industry, private capital itself began to assume the appearance of modern technology, the management experts lending to the power of capital the sanction of objective science. Not alone the actual machinery of production but the entire bureaucratic operation of corporate enterprise took on the guise of an efficient, well-oiled mechanism - the very embodiment of technical reason - against which individual opposition could not but appear "irrational"... Born into the world of production, the corporate engineers of science-based industry had taken for their task the production of a world.
>
> - David Noble, America By Design (O.U.P., N.Y. 1980, p. xxvi,320)

For engineer reformers and technocratic dreamers in the first decades of the century, the economic dynamic which had created and revealed to the world the figure who could administer away the contradictions of "machine civilization" - the modern manager - emerged from the heart of capitalism itself. Luigi Fontanelli, in a report to the Assembly of the National Council of Corporations in January, 1933 (at which Mussolini was also present) explained:

> It was not fascism but capitalism which signalled the end of capitalism itself...It was not the corporative idea but the machine and the joint-stock company that cleared space among the ruins of capitalist civilization. [1]

In a similar vein, management analyst and corporatist enthusiast Armando Lodolini highlighted one of the dominant features of modern industrial capitalism in the fittingly named reformist journal L'organizzazione (to which Giuseppe Bottai was also a contributor):

> The rennovating element of today consists in the presence of

> a managerial staff between the capitalist and the labour force. The manager of today is increasingly separated from the capitalist entrepreneur of the last century and pre-war period. The function of capital has become an end in itself - that of finance and credit. The firm, on the other hand, represents an "organization", created as a work of art through the efforts and talent of management. There is clearly a vast difference between the old capitalist enterprise and the modern structures of industrial organization. The latter has a wide-ranging vision of the future...The modern enterprise is not concerned with immediate gain or speculation. Its function, rather, is to develop the buying power of consumers... This is a revolution in production, because the firm's goal is no longer merely to serve individual interests but has become a "public" enterprise...
>
> From such a form of analysis one is led to the concept of the corporatist state - today in Italy, tomorrow throughout the world...the concept of organization is the most vital element of the corporatist state. [2]

That such a discourse was widely diffused in 1920s Italy is indicated in a speech given to a 1928 congress of the national employers' organization (CGI), in which Mussolini himself pointed out how the planning procedures that provided the techniques for laying down the base to the new economic order, the corporatist order, were the product of a process of self-transformation internal to the capitalist production process itself (adding the obbligatory dose of self-congratulation):

> Today you are in the avant-garde of a great transformation, a transformation that is coming to fruition in the capitalist economy, and that is a prelude - perhaps not only in Italy - to a new type of corporatist economy.
>
> I am proud to have foreseen this fatal process in the immediate post-war period. The capitalist as he was depicted by the pre-socialist literature no longer exists. A separation between capital and management...has taken place... Shareholders are nowadays often innumerable. While capital was becoming anonymous and the capitalist the same, the industrial manager...was rising to a position of primary importance in the economy... [3]

The underlying economic and technical features of the "new" capitalism which characterized the particular historical moment in which corporatist reasoning took form, and that defined the internal mechanism through which capitalism would somehow be transformed into something other than itself, had been succinctly described by Thorstein Veblen in 1921. In The Engineers and the Price System (a brilliant and

fascinating work that represents the same contradictions which the analysis, at the same time, reveals), Veblen argued that in earlier decades of the "machine era" the routine of management was to find ways of speeding up production of maximum capacity.

> That was before standardization of processes and of unit products and fabrication of parts had been carried far, and therefore before quantity production had taken on anything like its later range and reach. And partly because of this fact...the ordinary volume of output in the mechanical industries was still relatively slight and manageable. Therefore those concerns that were engaged in these industries still had a fairly open market capable of taking up any reasonable increase of output...Such an open market meant a fair chance for competitive production, without too much risk of overstocking...The industrial situation so outlined began visibly to give way toward the middle of the nineteenth century in England, and at a correspondingly later period in America. The productive capacity of the mechanical industry was visible overtaking the capacity of the market, so that free competition without afterthought was no longer a sound footing on which to manage production...the period of transition to a general rule of restriction in industry comes on at the time. This critical period in the affairs of industrial business coincides roughly with the coming in of corporation finance as the ordinary and typical method of controllir the industrial output...it has become the ordinary duty of the corporate management to adjust production to the requirements of the market by restricting the output to what the traffic will bear; that is to say, what will yield the largest net earnings... the control of the requisite running balance of sabotage, (has) been reduced to a routine governed by settled principles of procedure. [4]

Ironically, it was the inherent instability of the increasing capitalization of the production process that had created the problems with which corporatist were attempting to deal. Once technical change had become a socially endogenous phenomenon, competition within and between industrial sectors became a permanent and integral feature of the economic system. Further capitalization of production, as opposed to trading activities, had become of greater importance in the creation wealth, though the economies of scale and overproduction problems that resulted also generated the "irrational" structures that were the other side of technical rationality. Despite corporatist optimism, the integration of technical change within the production process had created as much uncertainty as it had potential for rational planning: "Henceforth, industrial society could no longer be

anything other than potentially anarchic, in an economic sense, if only because of the vastly increased number of specialised centres of productive activity, each at all times both a possible source of technological change as well as having to react to such changes in 'customer' and 'supplier' and 'competitor' firms." [5]

Of early twentieth century economists, Veblen was certainly among the most sensitive to this apparent contradiction, and spent a good part of his career trying to articulate the problem. His meditations on the problem also did much to inform the practical conceptualization of reformist interventions in the United States, such as Herbert Hoover's "vision" of an "associative state".

Technological convergence had determined, Veblen thought, the evolution of the integrated corporation, both for technical and economic reasons, since supply networks and contracting procedures could operate internally and thus save considerably on time wasted with middlemen. [6] The analysis began, of course, with an observation on modern technological processes themselves:

> not one of the mechanical processes carried on by the use of a given outfit of appliances is independent of other processes going on elsewhere. Each draws upon and presupposes the proper working of many other processes of a similarly mechanical nature. [7]

Following from this general nature of the production process, and the need for precision and the fluid operation of exchanges between complementary sectors, "standard physical measurements are of the essence of the machine's regime." [8] Moreover,

> materials, to answer the need of standardized industry, must be drawn from certain standard sources at a definite rate of supply. Hence any given detail industry depends closely on receiving its supplies from certain relatively few, industrial establishments whose work belongs earlier in the process of elaboration. [9]

From such technical considerations internal to the manufacturing process, Veblen then passed into the question of administration and higher level

organization:

> Machine production leads to a standardization of services as well as goods...To make effective use of the modern system of communications in any or all of its ramifications...men are required to adapt their needs and their motions to the exigencies of the process whereby this civilized method of intercourse is carried into effect. The service is standardized, and therefore the use of it is standardized also. Schedules of time, place, and circumstance rule throughout...This mechanical concatenation of industrial processes makes for solidarity in the administration of any group of related industries, and more remotely it makes for solidarity in the management of the entire industrial traffic of the community. [10]

At this point in the discourse, however, Veblen runs up against a problem - "business". It was by business relations that coordination and transactions between industrial units were adjusted and re-adjusted, and these relations

> are always reducible to pecuniary terms...It therefore rests with the businessmen to make or mar the running of adjustments of industry. The larger and more close-knit and more delicately balanced the industrial system, and the larger the constituent units, the larger and more far-reaching will be the effect of each business move in this field. [11]

As modern integrated industrial processes gained ground, superceding the unsophisticated and uncoordinated organization of production which preceded them, and as markets expanded, "the pecuniary side of the enterprise came to require more unremitting attention, as the chances for gain or loss through business relations simply, aside from industrial efficiency, grew greater in number and magnitude." [12] Paradoxically, it was precisely the inherent structural features of the new system of production which facilitated the self-destruction of its own implicit harmony - indeed, the systematic creation of disorder through interrupting the smooth running of technological processes seemed to form an integral part of the procedure of reproducing the system as a whole. Although the welfare of the community depended, Veblen argued, on the smooth, uninterrupted functioning of the industrial system, sometimes "business" had an interest in upsetting this balance by periodically creating "disturbances": "This class of businessmen, in so far as they have no ulterior strategic ends to serve, have an interest in making the

disturbances of the system large and frequent, since it is in the conjuncture of change that their gain emerges." [13]

The systematic creation of scarcity, therefore, had become a permanent and intrinsic part of the economic system. Integrated technological processes had allowed for the productive capacity of the industrial system to far exceed what the community was given to consume: "The requirements of the aggregate livelihood are so far short of the possible output of goods by modern methods as to leave a very wide margin for waste and parasitic income."[14]

By the time Veblen came to write The Engineers and the Price System in 1921, the critique had been elaborated to include, not only "business", but the structures of political society as well:

> the rate and volume of output must be adjusted to the needs of the market, not to the working capacity of available resources, equipment and manpower, nor to the community's need of consumable goods...Rate and volume of output can, of course, not be adjusted by exceeding the productive capacity of the industrial system. So it has to be regulated by keeping short of maximum production by more or less as the condition of the market may require... (and this sabotage) can best be administered on a comprehensive plan and by a centralized authority, since the country's industry is of the nature of a comprehensive interlocking system, whereas the business concerns which are called on to control the motions of this industrial system will necessarily work piecemeal, in severalty and at cross purposes...Even a reasonable amount of collusion among the interested business concerns will not by itself suffice to carry on that comprehensive moving equilibrium of sabotage that is required to preserve the business community fro recurrent collapse or stagnation...it follows from the nature of the case that the nation's lawgivers and administration will have some share in administering that necessary modicum of sabotage that must always go into the day's work of carrying on industry by business methods and for business purposes...So it is always considered necessary...to impose and maintain a certain balance or proportion among the several branches of industry...the chief and nearly sole means of maintaining such a fabricated balance and proportion among the nation's industries is to obstruct the traffic at some critical point by prohibiting or penalizing any exuberant undesirables among these branches of industry. [15]

The "centralized authority" Veblen was referring to was primarily the Federal Reserve system, which, in his view, was explicitly established to protect banking interests from the threat of liquidation if the extension of credit and corporate securties resulted in an excessive inflation of

values. Credits and debits were, in effect, pooled within a closed financial system, which was the structural antithesis of the rationally organized network of interlocking technological processes, which, at the same time, constituted the object of business speculation. [16]

The means to exit from this morass of social contradictions Veblen found while working at the New School for Social Research in Princeton. Otto Beyer's article "An Engineering Approach to Industrial Organization" furnished Veblen with his concept of a "Soviet of technicians", who would be ultimately responsible for allocating resources in production, ensure full employment, and avoid waste and duplication in industry. As collegue and collaborator Walter Rautenstrauch - chairman of Columbia's department of industrial engineering and close personal friend of Harlow Person, the managing director of the Taylor Society - stated: the industrial engineer "has pioneered in establishing and applying the principles of organization and management to industry and in formulating principles of industrial economics for the control of productive operations." [17] It was this function, as the supreme representative of disinterested rationality, that both gave the engineer the right and the competence to be the ultimate arbiter on how resources were to be allocated in economic society. [18]

The same system of economic organization, therefore - through an increasing technological sophistication and expansion in the means of production - produced an irresolvable structural contradiction which much of early twentieth century reform efforts, corporatism included, attempted to grapple with : systematic and rational problem solving procedures operating at the micro level of the firm, but seeming, at the same time, to serve only "irrational" ends at the macro level of the economy. [19] Early century reform programs informed by the managerial model constituted precisely an attempt to bridge the abyss between micro and macro levels, by extrapolating the systematic and functional rationality operating at the micro level of the industrial

system onto the competitive anarchy of the economy as a whole. Logic dictated that the two levels could only function and be defined interdependently and dialectically - that hierarchical and rational organization at the company level depended on the continual stimulus of competition, just as competing efficiently depended on rigid managerial procedures at the micro level. For reformers, however, faith in the industrial system and its managers prevailed, while the destructive competition which provided the whole mechanism with its dynamic was insistently denounced. As the tensions grew greater, as technology advanced and the rationality of production seemed to increase in inverse proportion to the rationality of the system as a whole, the ambitions and programs for resolving the irresolvable increased in scope.

In 1931, when the corporatist state, the institutional expression of managerial efficiency, was still no more than an ineffective and ignored bureaucracy in Italy, Giuseppe Bottai elaborated his fantasies even further:

> Between the liberal and the soviet system there is the possibility of a third system, which could be called "managed commerce"...It is based on the principle of delimiting areas of competence with countries whose economies are competing with ours, and on the principle of making arrangements with countries having complementary economies...proceeding from national economies to an international economy, balancing production and consumption, imports and exports, according to a thesis argued by our representative at the International Labour Office...Such is the initiative of Italy in the world... [20]

How such a system of "managed commerce" would differ from the prevailing situation of monopoly privileges and cartels was explained by Bruno Biagi, undersecretary at the ministry of Corporations, at the seventh session of the International Labour Conference in Geneva in 1933. Taking the example of the fascist state as his model, Biagi explained that the political authority should not be conceived and organized to intervene directly in

production. Its function, rather, would be to mediate the creation of a system of "self-government" whereby workers' organizations and companies would be organized in "cooperative corporate bodies", which, Biagi emphasized, was the identical conception to that of International Labour Office director Albert Thomas.[21] While cartels and monopolies served to concentrate power in the hands of a few individuals, the corporatist idea of employer and employee syndicates would ensure representation for all, and was thus the only feasible conception for the international economic order as well.[22]

For corporatist reformers, the conviction that their model had more than local applicability was an important aspect of their discourse. Camillo Pellizzi, the Italian translator of James Burnham's The Managerial Revolution and member of the fascist movement from its earliest days, articulated this conviction in a retrospective lament on the failure of the model:

> Italian fascism was a local manifestation of a much vaster historical phenomenon, which had very specific and identifiable characteristics. We have no better work that summarizes and interprets these characteristics...than a volume written by an American called The Managerial Revolution...to understand the failure of fascism means, in large part, to understand the most important political problem of the epoch in which - however precariously - we live.[23]

Naturally, transferring the domain of rationality from production to civil society could only be achieved through the political mobilization of technical and industrial personnel, which, if the scheme was to be effective, presupposed that they would be free of dependent ties to "vested interests." In the immediate post-war period, Pellizzi explained, "the word 'competence' acquired the weight of a genuine political slogan...'more space to competence' was...a translation or 'sublimation' in civilian terms of military hierarchy".[24] However, if the military hierarchy was determined by length of service, in civilian life it had to come from the technical and functional abilities of individuals. The challenge of reform was

to incorporate these abilities into the structure of political organization, and it was here that corporatism made its greatest claims to success. "In reality," Pellizzi argued,

> the only 'technicians' who took part in the fascist movement - both before and after the March on Rome - were the technicians of political organization. That is, the same party managers who had the highest public positions, just as in the bolshevik or Nazi regimes...in brief, 'technicians' were completely subordinated to the 'politicians'...Not only had certain large agrarian and industrial interests found the intervention of the fascist squads convenient...this was also true for an infinity of other minor interests, all more or less linked psychologically and structurally to the institution of property. 25

That "technological" and "political" interests could be compatible in a "managed" economy did not form part of the corporatist Pellizzi's analysis, and within the terms of corporatist reasoning the problem proved as obdurate as its solution seemed elusive. In January 1933, in his speech to the Assembly of the National Council of Corporations, Luigi Fontanelli could still make the tired plea: sooner or later, he said,

> technicians will give some sign that they have understood the fundamental revolutionary position that has been assigned them in the new corporatist society, which... will be realized when they move up on to the stage as protagonists, rather than remaining in the spectator's seat. Technicians do not constitute...the <u>third element</u>, but the first, because they represent the highest expression of labour - <u>labour that manages</u>. 26

Bottai as well, who was perhaps as aware as anyone that the corporatist economy could never be anything more than an institutional mirror image of the contradiction that it was designed to resolve, continued to cling to the myth. To a nation wide gathering of engineers in May 1931 he declared that, through the syndicates, fascism had rid Italy of "lawyer politics", by ensuring collaboration between politicians and

professional men:

> Like you, we (i.e. politicians) love facts. We find, as you do, an ideal and poetic light in the apparent aridness of numbers, figures, graphs, geometrical figures, scientific laws...This, engineers, is our time. If new developments in civil society have greatly increased social needs, you are the ones to satisfy them...you, who in your capacity as inventors and technicians, and in the context of the progressive de-personalization of capital, have the responsibility to oriente the awakened energies towards a higher form of human civilization.
>
> It is in the organization of production...that the talent of engineers...must stamp itself on the disordered and uncoordinated activity of speculators.
>
> The production process consists in...a transformation of natural resources into capital. This is why scientific and inventive intelligence is the fundamental factor in the modern economy...the engineers' part in this work is profound - not as passive executors but as conscious animators... Italy has become a great enterprise, and the Italian nation a vast workshop. The art of managing it is indeed a great challenge. [27]

Almost in the same breath, however, the barren formalism of such a discourse - which aimed to use the tools of industrial capitalism to create something other than capitalism - received its weary acknowledgement: "It will take time before some classes, saved from the social and political chaos of 1919-1922, understand what the regime has done for them since 1922 in the economic field." [28]

The purpose here has been to highlight the point that many of the tensions which underpinned the corporatist reform program inhere in the social system of science-based industrial capitalism. The contradictions that emerged were not defined geographically, rather they appeared as an indefeasible appendage of a system of production. Viewed analytically, the problem of corporatism in inter-war Italy was in part the problem enunciated by Veblen, who simultaneously

as he called for the formation of a "Soviet of technicians" to run America's economic system, had to concede that

> corporation finance, at its best and soundest, has now become a matter of comprehensive and standardized bureaucratic routine...and the same experience has put the financial houses in direct touch with the technological general staff of the industrial system, whose surveillance has become increasingly imperative to the conduct of any profitable enterprise in industry...The consulting engineers of the standard type...are commercialized technologists, whose work it is to appraise the industrial value of any given enterprise with a view to its commercial exploitation. They are a cross between a technological specialist and a commercial agent...Their normal position is that of an employee of the investment bankers...The case of the efficiency engineers, or scientific management experts, is somewhat similar...They are, by force of circumstances, the keepers of the community's material welfare; although they have hitherto been acting, in effect, as keepers and providers of free income for the kept classes. [29]

In the chapters to follow, an attempt will be made to explain why, in the historically specific environment of 1920s Italy, the inherent tensions in industrial capitalism between technical rationality and "pecuniary interests" as described in the above analysis - and which predisposed engineers towards the "technocratic myth-making" characteristic of the profession - emerged at the level of political discourse in the form of corporatist reformism. It will be argued that the main causative factors responsible for this phenomenon were the contradictions engendered by an inappropriate development model (viewed as a function of factor endowment and the prevailing social and institutional organization), and the historical failure to make the institutional reforms and social investment which the corporatist model presupposed. Indeed, such reforms and investment would have made the appearance of a discourse constructed to manipulate contradictions - the ideology of social harmony through corporatist arrangements - socially redundant. If the concept of ideology in general is to have any analytical usefulness at all, it can only emerge through the critical process itself of documenting historical and social failure.

Chapter II: Technology Transfer, Factor Availability and the State

Chapter II. Introduction

Precisely how the terms of the argument - presented in general form above - were formulated and articulated varied according to specific historically determined features of a given environment. At this point, we will concentrate on Italy's endowment of production factors, particularly raw materials viewed as a function of available technological options, since the terms of an argument that would play a central role in corporatist considerations for economic and social reform had been well defined earlier by such figures as Giuseppe Colombo. [1]

In these arguments the question of energy was without doubt regarded as one of the most crucial, and was integrally related to a series of positions taken on protectionism vs. free trade, monopoly vs. competition, organized labour, private vs. public management of resources, and so on.

At the time Colombo was active as an engineer-reformer, political activist and industrial entrepreneur, much of what underlay decision making in all three areas depended on the availability of economical sources of energy. In an essay written in 1890 for the journal La Perseveranza, Colombo expressed the importance of the problem of producing electrical energy for industry in apocalyptic terms: "It is the great problem of modern engineering...one can truly say that the future, not only of European industry but of society itself, depends on the solution of this problem." [2]

In this chapter, the problem revealed by Colombo will be looked at initially through the work of the inheritor of Colombo's reformist mantle - the fascist minister and engineer Giuseppe Belluzzo. Like Colombo before him, Belluzzo's career spanned the worlds of engineering,

business and politics, and Belluzzo himself clearly viewed his own work as falling within a historical continuum of reform interventions undertaken first by figures such as Colombo.

In addition, the constraints imposed on the resolution of the problematic identified by these figures - caused by the legacy of a capital intensive industrial model being grafted on to an institutional environment of clientelism and infrastructural backwardness - will be examined. It is argued that corporate expansion in the period of most rapid growth in the Italian economy (roughly 1895-1925) was in large part due to the tried and tested mechanism of the clientelistic social relationship, and that the islands of corporate "efficiency" that emerged, far from providing the economic base for a new form of social organization to be built, only further served to highlight the contradictions between industrial rationality and the structures of social and political mediation which remained profoundly resistant to change.

To capture this problem in a phrase, I have utilized the concept of inappropriate development as it has been employed in critiques of economic and social problems in today's Third World countries. As indicated in the analysis, however, one of the more important components of these critiques - the development expedient of protectionism as a means of increasing indigenous technological capacity in developing areas - requires considerations of a different kind when the analytical category of clientelism is introduced, as I have done here.

More importantly, it is argued that following an inappropriate development model created the tensions which predisposed social

reform to be conceived in terms of technological solutions, and that the presence of corporate structures representing organizational "efficiency" - such as the manufacturing giants Terni and Montecatini, whose success in capturing scarse resources was due in part to the manipulation of traditional clientelistic practices - only heightened these tensions.

Giuseppe Belluzzo and the Engineers' Critique

Until the appearance of electrical power on the technological horizon in Italy, the problem of economical fuel sources continued to vitiate the success of an industrialization program founded on the dominant contemporary model. The long term problem for Italian producers, endlessly re-stated in the reformist literature, was always to find a way of producing metallurgical coke for their furnaces using raw materials available in the country. As an alternative to coal imports, domestic deposits of lignite pitch and xyloids seemed to offer a possible solution.

In 1885 the founder of Terni corporation, Vincenzo Stefano Breda, sponsored the setting up of a committee to study the possibility of exploiting indigenous resources, especially lignite, to produce an economic metallurgical coke.[3] Experimentation revealed, however, that lignite and xyloids could only produce very fast burning coke, in small pieces, brittle, with a high powder content, producing a great deal of ash, and that was difficult to light.[4] Subsequent

tests done in France by Creusot changed the picture somewhat by showing that if the lignite was washed before burning, the ash content was considerably reduced, and similar experiments carried out in Germany using a mixture of lignite and common lithantrax coke produced usable iron. In theory therefore it appeared possible to manufacture metallurgical coke using indigenous non-sulphorous lignite pitch, but the preparatory processes of washing and drying to reduce the ash would be very expensive. [5]

During the first world war the experiments were repeated by Max Bondi's ILVA company, the results of which overturned the pre-war findings on such an alternative source of fuel. The friability of the resulting coke, it was determined, was not compatible with the very high pressures produced inside contemporary furnaces. [6]

Before the technological fix of "white coal" appeared on the industrial horizon, therefore, hopes for finding an alternative indigenous fuel source to provide for a lame and dependent industrial structure seemed very slim indeed.

Such then was part of the technological context which helped to define and distinguish alignments of power and interest, through the mechanisms of protectionsim and industrial clientelism, in pre-fascist Italian society. As R.A. Webster summarized:

> one of the most constant guidelines of the post-1876 system was precisely the integration of political and economic interest groups. Economically, these policies resulted in a complex network of protection and subsidies thrown around the peninsular market; politically, they led to transformism. [7]

The multitude of implications for reform, at all levels of society, in the resolution of the problem previously identified by Colombo would thus form one of the touchstones of industrial reform in the fascist period, and needs to be considered here.

In tracing the various interventions subsequent to Colombo on the question of industrial energy, inevitably the figure of Giuseppe Belluzzo appears again and again.[8] In all his work, as both engineer-industrialist and fascist minister, Belluzzo continued to insist that the resolution of most of Italy's social problems depended on a prior solving of the technical problem articulated by Colombo, and his appointment to the job of economics minister under the fascists testified to the political strength of such a reform discourse in a country without the traditional sources of industrial energy.

Born in Verona of working class parents in 1876, Belluzzo early lost his father and spent several years working as an office boy and in the book binding trade. At sixteen he won a scholarship to study at Milan Polytechnic, graduating from there with the "medaglia d'oro" awarded to the top student at the Polytechnic.[9] In 1910 he was appointed professor of hydraulic and thermal motor construction at the Higher Technical Institute of Milan, which was followed in 1929 with an appointment to the Chair of Machine construction at the school of engineering in Rome.

Two of his works - Le turbine a vapore ed a gas (1905) and La costruzione delle turbine a vapore (1923) - were considered major contributions in the field and were translated into French and English.

One of the largest locomotive construction firms, Breda, used Belluzzo's turbines, and they were installed in many Italian and foreign war ships, which included selling the motor to the Russian navy.

Belluzzo's first major interventions in the social world took place during the first world war when, in Milan, he founded the "Domestic Defence Committee". He was also a member of the testing group for military equipment ("consiglio superiore di collaudo dei materiali di guerra"), and was head of the historiographic office of the industrial section of the armaments ministry. He also made the technical contribution of designing a special type of 400mm shell with a 5 km. range.

His first contact with Mussolini came in the summer of 1920, in an exchange of ideas published in the journal Popolo d'Italia, over the question of the factory occupations in Turin. Disillusionment with parliamentary impotence and "trasformismo" naturally brought the two closer, and by 1924 Belluzzo had become a deputy as part of the so-called "listone" of candidates favourable to Mussolini's fascists. In July Belluzzo replaced Nava as minister of National Economy, the same day in which Giuseppe Volpi, the Venetian electrical industrialist substituted for the economist Alberto De Stefani at the Ministry of Finance. Three years later, both Belluzzo and Volpi left their respective ministries, Belluzzo moving to the job of minister of education, where he remained until September 1929, having in the meantime tried to press his industrial vision onto the educational system by making the study of scientific management obbligatory in all technical schools in Italy.

In October 1929 Belluzzo was nominated minister of state, and the same year was re-elected fascist deputy in what was by now, of course, only a one party state. In 1934 he was also appointed Senator. During the entire period, he was also an important entrepreneurial figure, investor and administrator in a number of large production

companies, including acting as president of the steel and shipbuilding corporation, the Società Ansaldo Cogne, the Electrical corporation of the comune of Milan, the firm Cogne Girod, and many others.

After the second world war Belluzzo continued with his technical work, primarily in the area of high powered industrial motors, as well as working with the military on aeroplane and ship's engine design. He died in 1952 at the age of 76.

As with Colombo, with whom he had worked and studied in Milan, Belluzzo would well represent the particular brand of Italian engineer, entrepreneur and reformer, whose politics and social philosophy were profoundly rooted in technical considerations on the resource base of the Italian economy. Endlessly repeated, Belluzzo expressed these considerations consisely at the April 1926 Milan Industrial Exposition:

> Italy must slowly liberate itself from the habit of adopting foreign production methods, based on the use of iron and coal, and create a production civilization founded on the use of energy and raw materials that we have at our disposal...the new society will be founded... on the direct utilization of capital that is administered to us daily by the sun, and on different raw materials from those now employed: that is, the new society will be founded on the use of electricity. [10]

For Belluzzo, as for Colombo before him, the alternative technologies of electrical power generation and chemical synthesis which had brought in the new century, had provided the first real alternative to the British model, and pointed the way to a philosophy of social production that promised to liberate Italy from its dependent position as one of the "proletarians" of Europe. [11] Well placed to be strongly sensitive to the technological nature of economic dependence and subordination, engineers, and Belluzzo foremost among them in inter-war Italy, approached political problems from considerations based on technological possibilities. Consciousness of "proletarian" status

as a nation,and political mobilization of men like Belluzzo inspired by it, should not therefore be analyzed away as a manifestation of a nebulous "nationalism", but rather viewed as a political expression of tensions produced, in a particular social class, by professional reflection on technical options. When the engineer S. Passer, in a 1919 article entitled "the Social and Political Mission of the Italian Electrical Association", wrote that "Italy is the great proletariat... and as proletariat its working and productive life is dependent on the economic block that is preparing a rationing of raw materials for us" - he was speaking first as an engineer, frustrated by undeveloped technological possibilities, and secondly as a "nationalist".[12]

Belluzzo himself explained the character of the technological choices that had resulted in Italy being a "proletarian" in the international division of labour:

> The criteria, the methods of the fusion of cast iron came to us from our own traditions and from England, which, in particular, gave us the furnaces and production procedures. But in England the question of fuel economy has always been of very little importance. Abundance is always the mother of waste...Analysis, chemical analysis is needed in our foundries...how many of our foundries have a chemical laboratory?...[13]

Even the fundamentals of construction design had to be reconsidered and reformulated. In general, in Italian mechanical technology of British origin, heat conserving concepts and technologies were completely ignored. In iron molding forges, for example, low pressure boilers with open cylinders (of British make) were dominant in Italy and were a tremendous waste of valuable fuel. Small, cumulative modifications, such as changing boiler and chimney design to better conserve heat, were therefore necessary, as well as more sweeping technological renovation.[14]

The economic importance of resolving the problem of industrial energy was regarded as fundamental to the reform program of economic independence and increasing the competitive strength of Italian products in the international marketplace. From the beginning of the economic boom in Italy of the Giolittian period (starting from the mid 1890s) Italian producers had to import more than 90% of their fuel needs, to power production processes designed and constructed at the same point of origin. [15] "Italy has made the great mistake in the past," Belluzzo wrote in 1925, "of using equipment and engines conceived and constructed in countries in which the abundance of fossil fuels...caused output to be sacrificed to simplicity of construction and manoeuvre." [16] In particular, Belluzzo emphasized, the merchant navy, the military fleet and the railways all suffered from this problem, were the most inefficient consumers of fuel, and therefore the most economically inefficient industrial sectors. The problem was that virtually all engines used in the transport sector were British, and thus designed to accommodate cheap sources of solid fuel.[17] It hardly seems surprising, therefore, that "in such a gloomy picture, the appearance of electrical energy had psychological consequences in Italy similar to those provoked by the appearance of methane in the 1950s." [18]

To more fully appreciate the conception of reform advocated by individuals like Belluzzo, it is necessary to look more closely at the details of industrial "best practices" as they were understood at the time, and how industrial organization in Italy measured up against these practices. In addition to the inherent tensions in industrial capitalism between "engineering" and "business", it was a perception of specific undeveloped technological possibilities (technology understood as a social system of production, including external economies) that contributed to the formation of a social ideology by the "third element."

Technology Transfer, Indigenous Capability and Industrial Clientelism in Italian Development

As Sidney Pollard pointed out in analyzing the industrialization of the European continent, a single process of exporting a single model - the British - was the dominant feature of the European revolution in production:

> the most obvious item to be transferred was the new technology. That, it should be stressed, was transferred whole: there was no adaptation. The steam engines, spinning-mules, blast furnaces, or railway systems installed on the continent were exactly like the British ones, though in the early phases they might be ten or twenty years out of date by the time they were set up and, above all, they might be put in a different sequence. This was so even though the technical solutions developed in Britain had been answers to specific British problems and were appropriate to British factor endowments which might not always be those of the continent: cheap coal, plentiful but low-grade iron ore, easy access to colonial cotton, plentiful water, certain types of skilled labour, and so on. [1]

Although in practice it is rarely the case, given certain factor endowments the transfer of particular technologies can, in theory,be an almost wholly dynamic factor of development. If such resources are avilable, the cumulative effect of complementary technologies can be a forceful factor in economic development:

> Often, one innovation could not be extensively exploited in the absence of others or the introduction of one innovation made others more effective. Metallurgical improvements, for example, were absolutely indispensable to the construction of more efficient steam engines. The steam engine, in turn, was utilized for introducing a hot blast of air into the blast furnace. The hot blast, by improving the efficiency of the combustion process lowered fuel requirements and thereby reduced the price of iron. Thus cheaper metal meant cheaper power, and cheaper power was translated into even cheaper metal...Thus, part of the secret of the vast productivity improvements associated with the new industrial technology was that the separate innovations were often interrelated and mutually reinforcing. [2]

Immediately, however, in the essay quoted above Nathan Rosenberg goes on to point out that "the successful transfer of technology depends greatly upon the specific domestic circumstances in the recipient country." [3]

Such "domestic circumstances" would include - apart from physical endowment of natural resources - general levels of industrial skills in the recipient population, a political and administrative structure of power that is complementary to industrial development, financial resources, managerial skills and incentive systems. "Thus," as Rosenberg summarized, "the successful transfer of technology is not a matter of transporting a piece of hardware from one geographic location to another. It often involves much more subtle issues of selection and discrimination and a capacity to adapt and modify before the technology can function effectively in the new socioeconomic environment." [4]

When the Italian industrial "take off" began in the early 1880s, it was not only founded on the British iron and coal model, but, further, much of what was transferred was already either out of date or about to be by the time it arrived to initiate the "take off". The Siemens-Martin furnace, for example, most adapted to producing iron with scrap, was not introduced into Italy until 1878, fourteen years after it had begun operating in Britain. [5] Similarly, textile machinery was overwhelmingly of foreign origin. Indigenous industrial technology in the 1880s had improved little from the time of the Florence industrial exhibition twenty years earlier, when even Italy's most evolved industry, textiles, seemed primitive next to the self-acting mule of the British.

Until after world war II, the machine tool sector was also supplied almost exculsively from abroad. A lack of specialization was the particular characteristic of machine tool production in the peninsula. Especially from the 1890s to the first world war, most manufacturing in this sector was carried out by firms whose primary product was not machine tools. [6] Most of the demand for machine tools was met by imports, 50% of which came from Germany. [7] The sector suffered particularly weak

tariff protection (or rather, a high tariff on steel and iron imports weighed very heavily on the cost of machine construction)[8], which resulted in machine tool imports exceeding domestic production by 4½ times at the eve of world war I.[9] The blocking of German imports during the war, and the general push given to the engineering industries by the war itself, would, of course, significantly modify this situation, but imported machine tools would continue to form a very large part of the industry in Italy. In 1920, there were about sixty firms producing machine tools in italy, both for wood and metal working, totaling an annual production of 14,000 tons, while imports between 1919 and 1928 averaged about 6,700 tons/year.[10]

The weakness of this fundamental industry, retarded in its growth in part by the protection accorded the iron and steel industries, was also a consequence of the slow diffusion of electrical power in manufacturing. The ratio of horsepower/worker was low, the consequence of which was low productivity in the sector as a whole. The application of electricity to manufacturing industries depended on the availability of cheap electrical power, which in turn depended on the growth of the electrical utility industry, which had to wait for improved steam turbines for thermal power stations.[11]

The principal savings in adopting the electric motor over the steam engine were primarily in transmission costs (there was less loss of power in line friction than in belt transmission) and from the fact that consumption of energy stopped when the tool was shut down. Incorporating the electric motor directly into the tool or machine to be worked not only allowed very significant savings in transmission costs, but the

> effect was cumulating savings in capital, through reductions in floor space and in building construction and upkeep costs; no longer were the heavy, multi-storied structures with reinforced floors capable of supporting reciprocating steam engines needed. Additional, direct capital savings gained

> from retiring the plant's steam engine were in engine equipment and accessories and inventories of coal, lubricants, and spare parts. [12]

The potential advantages of the individual electric motor in manufacturing can perhaps be best appreciated by looking at the defects of the steam engine. Certainly one of the more important of these was

> that work on the plant floor had to be arranged around it, where its energy could readily reach the large power-consuming operations, not where organizational efficiency demanded. That is, several related operations might best have been grouped together; but if one of them happened to require a relatively large power input, it had to be separated from its group and placed closer to the steam engine. [13]

The steam engine was also disastrously wasteful of fuel, in that it "had to be run at full capacity even if only one operation in the whole plant (or department) had to be run." [14]

With the implementation of the electric motor, a breaking up of manufacturing operations was permitted, supplying power to points in the production process as required, as well as allowing for the "possibility of instant intensification of individual operations." [15] Apart from the savings in power costs involved, the possibilities for marked increases in output were perhaps even more significant. As Frank Broadbent reported to the British North-east Coast Institution of Shipbuilders and Engineers in 1905:

> In...cases under my observation the output of a complete works has been increased by 25%, owing to the steady speed and simple and efficient speed control which is possible by electric motor driving. As these increases in output are got without a corresponding increase in the wages or standing charges, the saving far outweighs any economy in power. [16]

The absence of belts and shafting in the system of electric motors also saved on indirect labour, since maintenance costs were considerably reduced. [17]

Taken overall,

> the derived demands (the application of electric motors) created were to be met only by overhaul of the entire manufacturing process. Shortly after steam power began to yield to electricity, installation of electric motors called attention to the obvious restraints placed upon efficiency by the steam engine. Its systems, practices, and factory organization became almost visibly redundant. Thus, as 'unit drive' electric power grew in plant after plant, thoroughgoing reorganization of factory layout and design took place. Machines and tools could now be put anywhere efficiency dictated, not where belts and shafts could most easily reach them. To these advantages were simultaneously added those of revamped industrial processes, leading to mass-production and batch-processing techniques. [18]

In Italy, as elsewhere, the diffusion of the electric motor in manufacturing operations went hand in hand with the process of industrialization. However, some important differences in the application of this technology should be pointed out. An industrial census of 1911 revealed that the percentage of industrial power provided by electric motors in relation to the total power installed was 47.9%. [19] Subsequent census in 1927 and 1937-38 indicated that the percentage of power supplied by the electric motor in manufacturing continued to rise, reaching levels of 58.8% and 76.5% respectively. [20] These figures appeared to correspond more or less with contemporary figures on the diffusion of this technology in other industrialized countries, the percentages being in 1927: for the United States 73%; Germany 67%; and Britain, in 1928, 48%. [21]

If looked at as a ratio of horsepower installed per worker, however, the situation seems rather different. In the ten years between 1927-1937, the ratio of hp/worker in Italian industry passed only from 1.19 to 1.82 kilowatts, while in Britain the corresponding figures were 5.6 and 7.5 kilowatts, and in the United States in 1929 the percentages, disaggregated by sector, were as follows: chemical and allied products, 8.8; iron and steel, 7.58; stone, clay and glass, 8.79; vehicles, 3.3; textiles, 2.43; leather, 1.37; tobacco, 0.56. [22] The disaggregated figures for Italian

industry in 1927 are: metallurgy, 3.3 kw/worker; paper manufacture, 1.6; chemical industries, 1.5; and the lowest ratio of electric power installed per worker was in the machine tool industry itself, registering in 1927 only 0.7 kw/worker, less even than the food producing industries, which were a low energy consumer.[23] The ratio for the engineering industries improved somewhat during the following decade, rising to 1.4 kw/wage earner, however this improvement was offset by highly variable utilization of capacity during the same period. This indicated an inefficient utilization of available resources and inconsistencies in "flow line" production, due, primarily, to overcapitalization of plant in relation to demand and complementary phases in the production process.[24] Often large and complicated machines were used to perform operations which would have been better done by smaller, more specialized and less costly tools, and would have eliminated a good deal of waste of resources that was endemic to the sector.[25]

Apart from the complicated story of the interests at work in the utility industries - which were a continual brake on the formation of a national power network to facilitate a more efficient load factor in energy distribution, allowing therefore for more specialization and more efficient utilization of capacity for the machine building industries - the blocking of indigenous development in this sector (the making of machines by machines being a basic indicator of capitalist growth in modern industry) was closely tied up with expansion in the highly protected sectors of iron and steel. The nature of the interlocking fortunes of the iron and steel industries and the machine building sector is important to emphasize, and was well described by Harry Jerome:

> A machine is a composite of ideas, embodied in patents, blueprints and specifications, and of materials - chiefly steel shapes, iron castings and wooden parts - arranged in accordance therewith. Consequently, the major operating

> departments of a machine-producing plant, aside from the engineering and planning divisions, are the foundry, machine-shop and assembling divisions. If fact, in many specialized machine plants the parts are bought in semi-finished form and the plant operations consist largely of the assembling process. We can, therefore, find good clues to the nature of the machine-producing industries by an examination of data pertaining to foundries and machine shops. The latter industries, in turn, draw their basic materials chiefly from the iron and steel industry. [26]

In Italy, throughout the period both before and after the first world war, a large part of the iron and steel sector was in the hands of a single powerful company - Terni - at least as regarded government military contracts, which formed the largest market for iron and steel products. [27]

Founded in 1884 to produce steel using scrap with the Siemens-Martin furnace, Terni enjoyed tariff protection from the beginning. From its inception, the high coal requirement of iron and steel production was a major obstacle in the expansion of the company. [28] Although planned as a wide-ranging scheme to produce iron and steel on a completely integrated production cycle, using materials from the Isola d'Elba for cast iron production with coke furnaces, the company's administration underestimated from the start the technical, organizational and financial outlay required. [29]

Thus, from 1904 the Banca Commerciale Italiana, which played such a large role in Italy's industrial growth during the final decade of the nineteenth century, entered the business of Terni. It was during these years, under the direction of Giuseppe Orlando and the "Genovesi", that technical and financial organs of Terni were consolidated, though the growth of the company in this period was more the result of financial combinations undertaken by the Commerciale, than by productivity improvements. According to Franco Bonelli, the only elements that kept everything together were a few people who governed both Terni and the other firms under the financial control of the Banca Commerciale -

Terni, until world war I, was a "mere fact of power", important because of the political and financial influence of its administrators working outside the company's immediate operations.[30]

From the last years of the nineteenth century until the outbreak of the war, Terni was primarily a producer of semi-finished materials for shipbuilding. From 1904, and under pressure of competition from Ansaldo of Genova, a massive project of new investment was undertaken in capital equipment for production of hulls, canons, bullets and larger caliber ammunition, which left the company overcapitalized, and which even pre-war military demand could not meet.[31]

Only from the end of 1915, basing its operations on providing materials to complementary producers in the construction of dreadnoughts for the war, would Terni begin to operate at full capacity. No new investments were made, however - working at full capacity meant simply mobilization of previously unused plant. In any case, the increase in output allowed for a previously unknown rise in retained earnings, and made possible the subsequent post-war expansion of Terni into the sector that would, for the first time, permit Italian industry to see "on the horizon the rising of the liberating star from the tyranny of coal": electrical energy from natural water flows.[32]

The man primarily responsible for growth in this direction was the electrical engineering graduate from Turin, Arturo Bocciardo. Bocciardo had begun his career as a manager in the machine building firm of Sestri Ponente of San Giorgio, but it was in helping to manage and organize the war effort that provided him with the channels to power which would make his subsequent career.[33]

As head of the metals supply office of the Ligurian Regional Committee of the Ministry of Arms and Munitions, Bocciardo was responsible for coordinating the allocation of resources and manpower in the entire industria

zone in and around the port of Genova. His intervention in the mediation of affairs between private and public power in Liguria continued into the post-war period when he participated in the inter-ministerial junta formed to liquidate contracts undertaken between the state and private industry during the war. In addition to mediating the demands of firms in relations with the government, he was also charged with examining the general industrial situation from the reformist point of view of organizing for change in the technical base of Italian industry. Leaving public life in 1920, he became part of the board of directors of Terni, where in 1922 he effected a merger with the company Carburo di Calcio, giving Terni a corporate strategy and structure that would remain fundamentally unchanged until nationalization in 1964.

The depression of 1920-21 marked an important turn around in Terni's history. Grossly overextended by financial manoeuvres and political calculation, and with a poorly integrated technical structure, Terni was thrown into a position of near bankruptcy and was salvaged only by the protectionist tariff of September, 1921.[34] Carburo di Calcio, by contrast, had a much more solid technical base, possessing important patents for production of calcium cyanamide, ammonium sulphate, and most importantly, synthetic ammonia using the Casale process. The crisis of 1921, however, left Carburo with large stockpiles of calcium cyanamide, as well as having to confront competition from Montecatini, which had become the majority shareholder in the Società Azotati for the production of ammonia. Carburo, therefore, started selling shares, most of which were taken up by Terni, supported financially by the Banca Commerciale, which had already denied financial assistance to Carburo.[35] The Commerciale, as indicated, owned Terni and was about to appoint Bocciardo head of the company.

At the same moment, Terni was testing its strength against the Italian state on the issue of war profits and corporation taxes. At the time Terni was preparing the merger with Carburo in the summer of 1922, its works were closed and it threatened bankruptcy if the demands for the "super-tax" were not withdrawn. The challenge proved successful, and the question of taxes on war profits was put aside for good.

With the takeover of Carburo, Terni also assumed legal control of the hydro resources of the Velino and Nera river basins. The areas concerned as buyers for the hydro energy produced by these river flows were the province of Perugia, the comunes of Terni and Spoleto, and, most importantly, the comune of Rome. In addition to purchasing key patents for the manufacture of organic compounds, therefore, the takeover of Carburo also ensured Terni an important place in the expanding utility sector. [36]

The electrical generation program that Terni inherited from Carburo was designed to eliminate the problem of a deficiency of supply in the north in winter because of freezing, and a dearth of supply in the south in summer, by incorporating and integrating water flows in a single network, "conceived (however) exclusively in function of a sales policy to industrial consumers, to the comune of Rome, and to the state railways and electricity distribution companies." [37] Electrical energy was very expensive and difficult to store, and control over these concessions was essential to providing an outlet for temporary excesses of energy, which the production of chemical products, undertaken by Terni in the takeover of Carburo, was designed to facilitate. An enormous polysectoral enterprise was to be created which, in order to maintain internal integration, and the policy of the systematic transference of resources from one production branch to another, would continue to keep afloat even losing operations. [38]

The additional problem of disputes with the comune of Rome, which had taken place earlier over control of hydro resources, were to be definitevely resolved during the years 1924-27, primarily through the decay of local power resulting from the appointment of some of Bocciardo's collegues in the fascist movement to positions of authority in the comunal administration. [39] Public bodies facilitated Terni's monopoly of energy supply concessions, with the compensation that local authorities were provided with energy at favourable rates.

By the mid-1920s, therefore, Terni had consolidated its position as one of the most powerful industrial complexes in the peninsula, competing only with Montecatini for production of chemical fertilizers, and the newly re-constituted Ansaldo for the manufacture of steel. In the utility industry by the late 1920s, zones of distribution had been partitioned off among the largest producers, sometimes generating energy at different frequencies, poorly integrated on the principle of a national network and a more wide-ranging policy of encouraging domestic consumption, but extensively linked up with large scale local industrial consumers.

In the case of Montecatini, competition with Terni was mollified by reaching agreements on production quotas and price levels in March-April 1924, which effectively passed costs for expansion of both firms onto agricultural producers, and, in the long term, involved a permanent transference of resources from the agricultural to the industrial sector of the economy. [40] The investment program designed to provide low cost electrical energy to industrial consumers was to change permanently the structure of resource allocation in the Italian economy, with the gradual creation of the institutional mechanisms for the systematic transference of resources from agriculture to industry. Looked at overall, the relationship between agriculture and industry during the fascist period was one of "a tie of subordination which braked the development of the agrarian sector." [41] As Domenico Preti wrote:

> The most clamorous case is perhaps that of the electrical industry. Perhaps no other branch of economic activity conditioned and held back the development of agriculture as did the electrical monopolies, for two reasons in particular. In the first place, in order to favour the interests of the electrical industry...the state ceded, in the form of private concessions, a large part of the country's water resources, a policy which had obvious negative consequences on agriculture. A system of discrimination was practiced between who would and would not have access to water; often exorbitant rates were charged by suppliers who, if their prices were not met, could "dump the excess in the ditch", even in times of dearth... Secondly, the very high monopoly prices imposed on agricultural consumers for bringing the water up from wells, rivers, etc., tended to discourage the construction of the requisite equipment. 42

At this point it should simply be stressed that the inherited practice of using public authorities as a means of securing private gain - partly a consequence of an original choice of an "inappropriate" development model, founded on a profoundly weak resource base - was if anything intensified during the post-war years of science-based industrial development, and the interests of the electrical industry are particularly important in this regard. This was true both for technical reasons concerning the question of maximizing the load factor in energy distribution, and the particular problems of the post-war economic conjuncture: large scale producers greatly overcapitalized and with low productivity levels; uncompetitive prices, and a process of technological convergence taking place in the international organization of production; and the end of economic compensation for industrial weakness coming from emigrant remittances, caused by the isolationist United States immigration policy of 1921. It should be borne in mind that although the form of the relationship between private and public power changed during the fascist period (embodied in the details of the legal system and economic concessions) according to changed circumstances in industry, the essence of the clientelistic rapport continued to tenaciously characterize the Italian economic system. Both the protectionism made necessary earlier by the adoption of the British industrial model

and post-war overcapitalization problems only gave an old phenomenon vigour.

At the level of the state, and having formally resolved the question of "interests" with a technologically informed model for society, "the fascist state preferred to give in to the corporatist pressures coming from the more powerful and organized classes and economic groups, choosing to delegate to these groups (often through the creation of the appropriate organs) specific prerogatives and powers, without claiming in exchange the obligation to submit to (the state's) control...It was precisely through the mechanisms of a corporatist and authoritarian state that reinforced in the ruling class...a mental habit of impunity, to consider the state and its institutions as things that could be used at their pleasure, for personal profit, without having to account to anyone." [43]

The "scientization" of certain production spheres in Italy therefore only slightly redefined the inherited system of power management and decision making about resource allocation. The characteristic dualist social and economic structure of the so-called "late" industrializers persisted unchanged: isolated enclaves of science based corporate production functioning within an investment starved context of infrastructural underdevelopment. In view of this problem, the following section will deal with the growth of the Italian chemical industry and the expansion of its dominant corporate representative, Montecatini.

Science-based production in the clientelistic state: the chemical industry and notes on the rise of Montecatini

"Before the war," the anonymous article in Ingegneria Italiana indicated in July 1918, "the primary function of the small scientific discovery in instigating progress...for industry...was not always generally recognized. Now, however, we must all be convinced that practical and economic success does not favour peoples with a more daring scientific imagination or mere cleverness. Rather, success is achieved by those who are ready to take in hand any new idea and systematically elaborate and develop it." [1]

Perhaps among the most important of these "small scientific discoveries" revealed by the exigencies of the war effort were those made in the field of chemical engineering. Writing in 1925, Belluzzo was categorical: "One can affirm, without fear of exaggeration, that victory or defeat of a nation at war will depend in future on that country's chemical industry." [2] If the history of technology and technological innovation has been in good part provoked by military requirements, the effect of the first world war on the chemical industry was not an exception. Apart from its intrinsic importance as a growth sector in inter-war Italy, the chemical industry is important to look at in tracing the background of the engineering ideology analyzed in the thesis. In particular, it is important to examine in the context of a tenaciously inadequate industrial infrastructure, administrative inefficiency in the political sphere, and an increasing dualist economic structure, characterized by pockets of capital intensive production in a larger picture of small scale, low productivity economic activity.

Throughout the nineteenth century, chemistry as taught in Italian polytechnics and universities was presented as an exclusively theoretical discipline. [3] Notwithstanding the successful efforts of Francesco Brioschi,

director of Milan Polytechnic, to obtain permission from the state in 1883 to establish the first university course in industrial chemistry, the basic problem remained of the lack of economic development which would justify further investment in technical education. As the head secretary of the Chamber of Commerce of Brescia and industrial reformer Filippo Carli wrote in L'altra guerra in 1916: "technical education cannot prosper by legislative fiat where economic development is lacking." [4] Indeed, until the war and the closing off of trade and supplies of raw materials from abroad, all forms of economic development requiring a broad theoretical base, and implying therefore stricter links with institutes of higher technical education, were decisively lacking in Italy. Throughout the nineteenth century, the figure of the chemical engineer in Italy was "almost superfluous". [5] The chemical techniques that were used until the war and after were almost all copied from abroad, and even these efforts were relatively insignificant and marginal. The modest pharmaceutica factory, for example, established by Carlo Erba was "more like a herboria than the German or Swiss factories." [6]

To better appreciate the difficulties of developing an integrated organic chemical industry in the Italian context, it would be useful to briefly describe something of the structure and requirements of the industry itself.

"Chemical products," as Guglielmo Koerner, director of the Regia Scuola Superiore di Agricultura of Milan explained in 1911,

> are for the most part consumed by other industries, and many of them can only be manufactured in large quantities. Only in this way is it possible to introduce improvements that would allow for utilization of so-called "dead time", and make the enterprise profitable. Therefore, only with an extensive industrial development that ensures...a certain consumption of products can the chemical industry survive and flourish.
>
> This industry in its most perfect form, and in contrast with other industries, does not have as its principal objective the manufacture of a given product. Instead, its goal is the most complete and rational utilization of all parts of a given raw material. [7]

As the principal characteristic of the chemical industry is that its products serve primarily as intermediate inputs for other industries, its optimum structure implies strict technological complementarity between customers and suppliers, widely agreed upon and applied standards, and highly skilled specialized personnel. Many of the raw materials used in the industry need not be purchased from third parties but are produced in the manufacturing process itself. In the production of hydrochloric acid, for example, sulphuric acid and ordinary salt were used as raw materials. A residual product of the process was anhydrous sodium sulphate, which was soluble in water and used in glass making, and which could be employed as a raw material in the production of crystallized sodium sulphate, which had many commercial uses, no less important than hydrochloric acid.[8] A further example could be cited from the iron industry at Piombino. Chemical procedures revealed that the slag from the production of liquid cast iron with the Siemens-Martin furnace could be used to manufacture cement.[9] Further, in the cokefication process, which lasted 24 hours, the gas that emerged in the distillation process could serve as a source of energy for heating the furnace itself. And the residual products of distillation were used for other purposes - tar for protection of wood products, benzol in the rubber industry, and ammoniac was transformed into ammonium sulphate to be used in fertilizer production.[10]

If raw materials for an industry could be manufactured by the same industry in the process of the sector producing for itself, so chemical procedures could redefine the utility of raw materials and enable the same goal to be reached by different means.[11] Magnesium sulphate, for instance, used in dyes and production of domestic salt, could be got from many minerals in nature which contain magnesium oxide, given the appropriate technical know how.[12] Similarly, it was revealed, carbonic acid, used in wine making, brewing and refrigeration, could be obtained from burning carbon coke.[13]

It is clear that the economies of scale possible by developing all the industrial linkages sugested by the micro processes of chemical production were enormous. Problems in Italy, however, ensured that none of the criteria for efficient macro level economic coordination could be effectively met: lack of investment capital and economical sources of fuel; absence of sufficient technical expertise; a disorganized and clientelistic state sector; [14] and a feudalized and minimally specialized industrial structure, because, as Belluzzo complained, of "the Italian (industrialist's) eagerness...to want to do everything on his own." [15]

More concretely, the problem of economic fuel was a heavy burden on developing a vigorous chemical industry based on the prevailing model. Although sulphur was available in the Sicilian provinces of Caltanissetta, Girgenti, Catania, Caltagirone,and in somewhat smaller quantities in the provinces of Palermo and Trapani, for the fundamentally important sulphuric acid (and therefore soda manufacture) the dearth of fossil fuels severly impeded its manufacture on a competitive scale. [16]

Nevertheless, late century demand for fertilizers and abundant quantities of pyrites in the Italian subsoil pushed the nascent chemical industry towards production of basic chemical products of a prevalently inorganic character. [17] Mining activities linked to the production of superphosphates and the extraction of iron pyrites were notably stepped up between 1900 and 1910, tied exclusively to the production of phosphate fertilizers.

Compared with superphosphate production, manufacture of potassium and nitrogen fertilizers was much less developed. The limited quantities of potassium salts that were consumed in fertilizer production (insignificant, in any case compared with the development of this mineral in the Erfurt region of central Germany) were almost exclusively used in agriculture in the north of Italy. According to Luigi Gasperini, "the limited employment in Italy of potassium fertilizers has been one of the main reasons why agriculture had such a slow development with respect to the countries of northern Europe,

and particularly compared with the vast productivity increase of German agriculture..."[18]

Apart from the limited development of potassium fertilizers in Italy, the chemical industry showed some signs of growth in the manufacture of industrial products by electrolytic methods. Before the first world war, there were various manufacturers - almost all controlled by the Banca Commerciale and Credito Italiano [19] - producing industrial chemicals. These included caustic soda, acetylene, potassium chlorates, calcium chloride, and particularly calcium carbide, which was indispensable in the manufacture of calcium cyanamide, acetylene and its derivatives, as well as lamp-black used in the fusion of metals. [20]

The production of caustic soda began in Italy in 1903 using the electrolytic method, by the Società italiana di elettrochimica at Bussi, where chlorine and its numerous derivatives were also manufactured in sufficient amounts to meet national demand. This effort was followed in 1906 with the establishment of an industrial chemical works at Brescia - the Società elettrica ed elettrochimica del Caffaro - which in 1912 began production of anhydrous caustic soda, fundamentally important in a vast range of industrial processes, and in the manufacture of sodium salts, soap, various organic chemical products, paints, and so on.

Other industrial chemicals which precariously and tentatively made their appearance in pre-war Italy were sodium nitrate and formaldahyde, both of which had significant industrial and medical applications. Manufacture started in 1910 by the Società Chimica Lombarda Bianchi, but fiscal burdens and customs duties made the necessary imports of methanol (or methyl alchohol), the raw material for these products, very expensive. [21]

What was missing in this general picture, however, was development of an indigenous organic and inorganic dye-stuffs industry. Its importance as a growth sector of science-based production was crucial:

> the core of science-based chemical industry, and the basis of German industrial superiority, remained the coal-tar dyestuff industry. Locus of synthetic organic chemistry, it was also the primary realm of organized, systematic scientific research. [22]

Until the first world war in Italy, 80% of the market in this basic sector, the foundation of the modern chemical industry, was covered by German imports. [23]

In the history of the organic chemical industry in Italy, one name lords above all the others - Montecatini. The company had begun in 1888 as a mining interest, exploiting the copper deposits of the Val di Cecina. In 1908 a period of expansion was initiated with the discovery of pyrite deposits at Boccheggiano, which was followed two years later with the takeover of the Unione Italiana Piriti, which brought under Montecatini's control the mines of Agordo and Gavorrano. From its control over mineral resources in Sicily, Romagna and Le Marche, Montecatini entered into industrial production of chemicals in 1913 with the formation of the Società per lo sviluppo dei superfosfati e dei prodotti chimici d'Italia, and consolidated its monopoly position in 1920 by absorbing the two largest producers of chemical fertilizers in Italy, the Unione Italiana and the Prodotti Chimici colla concimi.

The figure primarily responsible for Montecatini's strategy of expansion in this period was the engineer Guido Donegani, who took over running of the company in 1910. Even before the arrival of the fascists to power, Donegani had already been highly successful in combining his engineering career with being an active presence in both business organizations and parliamentary politics. As well as sitting on the board of directors of the Banca Commerciale, Donegani also was a member of the pre-fascist Permanent Commission for Industry and Commerce and commissioner on the committee for the examination of customs duties. [24] Together with

Galeazzo Ciano - future fascist minister of foreign affairs and the son the Costanzo Ciano, the central figure behind the formation of the new Ministry of Communications in 1924 - Donegani was also liberal parliamentary deputy in the list of the "national block". Subsequently, he would be "candidated", as Belluzzo had been, in the fascist "listone" of 1924, becoming then a member of the Fascist Confederation of Industry, president of the Federazione fascista degli esercenti delle industrie estrattive, vice-president of the Federazione degli industriali dei prodotti chimici, member of the Corporations for chemistry and the extractive industries, as well as sitting on the Council of Mines and government committees for production of dies and nitrogen.[25]

Among Donegani's major successes from his political interventions during the fascist period were to secure tariff protection for his industry in July 1925 and April 1926, primarily through his close relationship with Giuseppe Volpi, fascist minister of finance, whose interests held monopoly control over the production and distribution of electrical energy in the Veneto region. With the success of this particular intervention in the field of tariff policy, Donegani practically ensured that the much heralded "battle for wheat" - "to liberate the Italian people from the slavery of foreign bread" - would be entirely stillborn. The "battle for wheat" was in fact an unqualified victory for producers of nitrogen fertilizers, which in practice meant victory for the unrivalled monopoly producer - Montecatini - whose production of this fertilizer passed from 5,000 tons in 1925 to 50,000 tons in 1930.[26]

By the mid-1920s, therefore, the technical and financial structure of Montecatini had grown into an enormous network of complementary interests, making it the largest producer in Italy of nitrogen and phosphate fertilizers, copper sulphate, paints, sulphur, pyrites, copper, zinc, lead, lignites, and its production activities also spread into marble cutting and finishing, as well as hydroelectric power interests.[27]

Undoubtedly, the most important step in Montecatini's expansion in the entire period up to the second world war, was the exploitation of the Fauser patent for producing synthetic ammonia, taken out in April 1921 by Fauser and acquired by Montecatini in December 1925.[28] Originally acquired by the Società Piemontese Ammonia of Milan in May 1925, this crucial patent, along with many others relating to the mechanical and chemical aspects of producing synthetic ammonia, were all passed on the same day (5th December, 1925) from the Società Piemontese Ammonia to Montecatini.[29]

This technical coup for Montecatini was not, of course, an industrial innovation, but simply acquisition of a process exploited for the first time on a large scale during the war in Germany. Essentially, the process had been discovered in 1904 by the physicist and chemist Haber, who had determined the reaction according to which one unit of nitrogen and three units of hydrogen produced two units of ammonia, at different pressures and temperatures. From this, a direct synthesis of ammonia from nitrogen and hydrogen was considered, though the technical difficulties were enormous because of the very high pressures and temperatures required. In collaboration with the technician Bosch, and enjoying the massive financial support of the chemical combine Badische Anilin und Soda Fabrik (BASF), the Haber method was put into operation in 1913. At the outbreak of the war, therefore, the Germans were in a position to overcome the blockade of nitrate supplies from Chile, the only previous source of raw materials for the manufacture of nitric acid, and therefore of explosives.[30]

Although the ammonia synthesis process was protected by German patents before the war, at its end the victors took rapid advantage of the German defeat on the technical front as well, forming a number of committees to appropriate invaluable patents. In the United States, all German chemical patents were confiscated by the offices of the Alien Property custodian, A. Mitchell Palmer, who "began selling the German

patents to American companies for the highest bids." [31] In Italy, a similar body was established in 1922 - the comitato autonomo per l'esame delle invenzioni - under the direction of the ubiquitous Belluzzo, who had been authorized by the reparations authorities to seize thirteen million lire in equipment and materials from German industry. [32]

In the meantime, the engineer from Novara, Giacomo Fauser, had succeeded in synthesizing ammonia by electrolytic methods. The hydrogen obtained in the electrolytic cells, designed by Fauser himself, was used to burn oxygen in the atmosphere to produce nitrogen which, together with the recovery of synthetic water and carbon, prepared the required gas mixture. From here, and passing through a catalyst, the gases reacted to form ammonia, which definitively "opened the way for the large scale production of chemical fertilizers." [33]

Industrial exploitation of Fauser's process was almost immediate, the result of the collaboration of the Imprese Elettriche Conti (subsequently part of Edison) and Donegani's Montecatini. Financial backing came from the Banca Commerciale, of which Conti was president and Donegani board member as already indicated. The result was the formation of the Societa` Elettrochimica Novarese, which began production of synthetic ammonia in 1923 at a rate of 1500 kilos per day. As indicated, the relevant patents were formally taken up by Montecatini in 1925, and what was to become one of the largest science-based industrial corporations in Europe had decisively, and anomalously, arrived in the peninsula.

In essence, this cryptic history of the rise of Montecatini serves primarily to highlight its singularity in the Italian industrial landscape, of the corporate fusion of science and industry. Montecatini flourished as an isolated island of production using advanced industrial techniques in the characteristic social, cultural and political context of trasformismo, political favouritism and economic clientelism, all of which, typically paradoxically, to some degree explain the success of the chemical giant.

The system of national power and economic organization which had taken form after 1876 - founded essentially on the idea that the state would absent itself from interfering in regional economic interests in exchange for political support - continued to reign unchallenged. This system of social organization and decision making had originated in the relationship between Rome and the latifondisti of the south, and, combined with protectionism for heavy industrial products in the late nineteenth century, had created a permanent brake on agricultural development in the south of Italy.

By the end of the century, this method of exercising authority through the particular form of the relationship between public and private power, had been generalized throughout the whole social and economic system. It must be emphasized that although the rise of science-based corporate industry after the war, such as the growth of Montecatini, represented a fundamentally new direction in investment strategy in Italian industry, the expansion of the new sectors was due, in good part, to the manipulation of the same mechanisms of power which had had the opposite effect in the south - that of keeping the area permanently underdeveloped. In practice therefore, and standing in blatant contrast with the subsequent reform rhetoric of engineers, industrial modernizers and corporatist technocrats - and which had in large part created the tensions which lay behind the rhetoric - "the entrepreneurial class... scarsely applied itself to the promotion of an industrial culture, through political and social intervention, since it had borrowed the ideological schemes of the dominant pre-industrial classes and, making subsequent adjustments, adapted them to the new social reality, both inside and outside the immediate world of production." [34] The result was the consolidation of a dualist economic structure, with a capital intensive sector absorbing most of the country's economic and social resources, without however complementary investment in social and industrial infrastructure being

made, to ensure that the technological sytems employed formed a more integral part of a larger spectrum of both market and non-market activities.

As will be looked into later, the forms of economic and administrative organization introduced by the mechanisms of war management - responding also to new technical exigencies in the organization of production - served in large part only to enhance the pre-existing system of managing social power, permitting industrialists to "enter directly into the political and bureaucratic machinery...obtaining the favours desired with greater efficacy by extra-legal and extra-parliamentary means rather than by direct political representation." [35] It was precisely the tensions created, however, by the apparent clash of rationally ordered science-based production, growing and flourishing in such a context of power management, that gave the engineering concept of a social system organized according to a technological model such strength in the years immediately prior to, during and immediately after the war. The sections which follow will deal with some of the unrealized possibilities, at an industrial level, which were both cause and effect of this pre-established pattern of organizing and allocating resources in Italy, and which were basic factors in both the corporatist conception as ideology and its failure as practice. These factors include the creation of a class of management personnel, the technical education system as a whole, the technical problem of industrial standardization, and the persistent problem of a unified national electrical power network.

Chapter III: The Breaking of the Chain: Non-Innovation and the Failed Revolution in Social Production

Chapter III. Introduction.

One of the primary theses of this paper is that the articulation of the corporatist reformist ideology in fascist Italy, informed in good part by the priorities of an engineering discourse, can be usefully analyzed as a function of failed practice within the terms of reference of the discourse itself. For the purposes of the present study therefore, the unresolved industrial and economic problems most important to consider in explaining the history of the failed reform project of corporatism have been identified as the following: the challenge of creating a class of "disinterested" corporate managers to ensure the efficient functioning of a social system organized on the corporate model; the problem of industrial credit and freeing investment funds for the capital goods sector; the organization of an integrated power supply network, and transport and communications sector; and the determination of widely agreed upon standards and norms for the production of industrial commodities.

This chapter will thus look at the progress and failures of reformist interventions in these areas, and try to place them in the context of a perceived "one best way" of organizing commodity production, for which the competitive strength of the newly emerging American economy had furnished the most challenging model.

The Problem of Management and the "anti-industrial spirit"

Certainly one of the most important problems of the Italian system of managing power and facilitating capital accumulation, and one of the most pressing challenges revealed by science-based industry to Italian capitalists, was that described by Giuseppe Koerner in 1911:

> In the chemical industry, much more than in other areas, the first and most important factor is a managerial mind capable of shrewd initiative, supported by experience and above all by a total command of the relevant scientific theory. Capital and Labour, which are generally considered the principal factors, are in fact relatively incidental. But that which is required above all is the illuminated spirit of enterprise, able to create a perfect industrial organism, not only from the theoretical point of view but even more importantly from the point of view of administration... [1]

New technologies required new costing and administrative procedures, which of course placed new demands on manpower. Even simple accounting in the early period of science-based industry involved different procedures, since, for example, the waste products of an industrial process had to be redefined for accounting purposes if, as was often the case, they could by re-cycled and re-used as raw materials in the production of another article. [2] The reorganizational requirements of highly capitalized science-based industry put great pressure both on administrative procedures internal to the industry to ensure stable utilization of capacity, to keep down costs and offset investment in fixed capital, and on the ordering of external economies: "those conditions of production that a particular branch of industry needs, but that an individual enterprise cannot provide for itself or, more commonly, that it need not provide for itself in a location where the industry conderned is well established. Examples are a skilled labour force, a network of suppliers, suitable

transport services, and so on." [3]

The origins of the new demands placed on the administration of the firm and the economy were primarily technological:

> The application of science to production, which began in the nineteenth century, changed the requirements for economic and industrial growth and stimulated the expansion of the state in all advanced countries.
>
> Where industrialization had previously depended on access to raw materials and unskilled labour, these needs were reduced by new forms of transport and communications, and synthetic materials. In their place were demands for an increasingly skilled workforce, for coordination of research and development across industrial sectors, and for technical standards to enable the interconnection and interchange of products to ensure economies of scale in manufacture. [4]

The importance of the uninterrupted flow of intermediate inputs between industrial sectors in science-based production had therefore become crucial, the rate of profit in one sector having become a function of productivity in another. Technical change had become increasingly associated with a growing reliance on general sectors - producers of services, communications, energy, transportation, and so on:

> It is the composition of interindustry sales that mirrors most directly the effects of changing technology and the organization of production. Intermediate inputs are the specific goods and services used to produce the gross national product. As methods of production change, more of one kind of input will be required and less of another - more chemicals, less steel, and so on - and the interdependence of individual supplying sectors will be changed accordingly. [5]

As Harry Jerome pointed out, in the inter-war period many of the innovations made to effect such integration between producers of intermediate inputs were made in the general area of handling:

> even the most diverse industries have one operation in common - handling. In all it is necessary to move materials from one processing operation to the next...One marked tendency in the modern movement for greater industrial efficiency is the effort to reduce handling through the rearrangement of equipment and processes to provide straight line flow. [6]

"Handling" need not be conceived as an operation purely internal to a firm or a particular production process, but can usefully be understood as the general movement of production inputs throughout the industrial system, including the movement of information through the system of communications, for example, which may act as a serious bottleneck in the continuous flow of production inputs. It is at points such as these, brought into relief at particular stages of technological development, that the line between fixed and social capital, between technological change and administrative reform, between private business activity and the function of the public authorities disappears:

> in producing for itself, society is also producing and reproducing itself, its work habits, institutions, relations between people, and dominant perceptions of reality...Here the fundamental relationship between society (social relations) and technology (forces of production) is a dialectical one, and thus, in essence, an identity, with the two being but different aspects of the single process of social production. [7]

The component of this "identity" between forces and relations of production which concerns us at this point regards administrative and procedural questions in modern industrial production. The economic and social importance of such forms of innovation, rising in parallel with new relationships of production and exchange operating at the "hardware" level of the economic system, can hardly be overemphasized: "If changes in business procedures and practices were patentable, the contribution of business change to the economic growth of the nation would be as widely recognized as the influence of mechanical inventions or the inflow of capital from abroad." [8]

In Europe of the early post-war period, it was in the delayed evolution of such organizational procedures, to correspond to the new technological practices, that some of the greatest bottlenecks were perceived to exist. In German industry, the problem appeared to have

been confronted and resolved with characteristic practicality:

> The men responsible for the administration must be experts in their respective spheres and the influence of the technical men will tend to override demands for excessive dividends. In Germany it is held more and more firmly that industry has no place for ornamental directors, and that the problems of management have to be studied as closely as technology and industrial science. [9]

The general question of qualified administrative and managerial personnel appeared with technological change, and in Italy, ponderously slow in uniting science and industry through the requisite structures and institutions for the production of this type of professional, the mystification of the social function of the neutral organizer grew in inverse proportion to such a figure's effective role in society. The longer problems were left unsolved in practice at the micro level of technical and administrative organization, the more grandiose became the paper schemes for reform at the highest levels of social organization.

That the problem of creating a class of technically skilled administrative personnel was an enduring one throughout the entire period up to the second world war emerged, for example, in Giulio Scagnetti's 1942 account of problems encountered with the Istituzione per la Ricostruzione Industriale (IRI) after 1933. [10] Established in January 1933 on the plan of the businessmen Alberto Beneduce and Donato Menichella, IRI was designed to cut "the embilical cord between banks and industry," and allow the state direct control over industrial credit. [11] The means by which credit decisions would be made at IRI were explained in a report by the Instituzione in 1938: "The administration of IRI is faithful to the principle that has always guided it: to maintain links with the firms concerned, particularly through personal contacts with company managers, and to reserve to its own offices only tasks of a purely inspective character." [12] The gravest difficulty that had to be confronted, however, as Scagnetti goes on to explain

> appeared from the very beginning, and regarded the human

> element - that is, the problem of finding...not only skilled technicians and workers, but particularly production managers...the formation of managerial personnel is not something that can be improvised. [13]

A lament often voiced by reformers from the days of Giuseppe Colombo on through the subsequent decades, very little of anything concrete was done about creating such a contingent of managerial personnel, both for private industry and for the infrastructural services complementary to it.

Lack of investment in the requisite manpower was, however, predicated on a series of failures on a technical level. The first step in reforming society through industrialization had, it was clear, to be to scientize industry. And this, in turn, depended on a concordant commercialization of theoretical research itself. In a speech made to the February 1921 Congress of the Italian Electrical Association, the physicist and industrial reformer O.M. Corbino - who had taken over the Ministry of Education from the philosopher Benedetto Croce in 1921, and was subsequently fascist minister of the National Economy - identified this as one of the fundamental problems in Italian economic life under the heading, "The anti-industrial spirit in Italy". [14]

Corbino began by pointing out that the technological revolution in sources of industrial energy "has determined a radical and profound transformation of human labour." [15] With the productive capacity of each nation so drastically increased by the massive amounts of energy made available by electricity, "the need to win the competitive struggle induced (the various producers) to streamline the manufacturing process, and to produce new and cheaper objects, and make them accessible to the masses... to produce in quantity and at low cost was the only way to tempt new buyers away from competitors. The result was the concentration of industries in ever vaster and more complex combines, and the need for greater capital investments, which are far beyond the capital available to isolated

individuals. What was demanded, therefore, was the intervention of that marvelous financial mechanism that is the joint-stock company." [16]

In Italy, however, Corbino continued, which lacked coal and iron as essential raw materials, industry suffered an invasion of cheap products from abroad, which overthrew artisanal production, "without large scale industry taking its place." [17] And even large scale industry, when it finally arrived in the peninsula, was of foreign origin:

> They came to do in our country what was not convenient to do at home. Large scale industry, was, therefore, in many sectors, also an object to be imported. [18]

Even in the period immediately before the outbreak of war, a period never before matched for industrial expansion, industrial production in Italy was insignificant compared to other areas. Consumption of coal was only 4% of German industrial consumption, and a massive trade deficit had to be balanced by emigrant remittances. [19] Moreover, "industry was always seen very negatively, sometimes with real mistrust". [20] Savings had always been used to invest in property development or government bonds, almost never in industrial assets. Industrial investment funds were therefore provided through savings, but always indirectly through bank deposits. Thus, in the end,

> our industries...sucked...the poisonous milk of speculation and "affarismo", while the formation of a real industrial consciousness was lacking in the country. This can come about only by a wide diffusion of direct industrial investments by the mass of citizens. [21]

"On this very ill organism," Corbino pursued his argument, "notwithstanding its apparent vitality, the great war struck...everything became easy and profitable in the field of industry...anything, however well or badly made, and independently of any economic considerations, was marketable." [22] Since the principal client for industrial products during the war was obviously the state, Corbino lamented, the whole economic structure powered ahead unhindered by normal social and economic constraints, fed by the

artificial stimulant of armaments production:

> normal production methods were revolutionized from the need to produce in a hurry and from the difficulties of procuring raw materials; the law of competition, with its sanction of death for any but the most efficient firms, was suppressed; labour was held back artificially by the fear of disciplinary measures, or by fear of having to share with those at the front the dangers of the trenches. [23]

Despite all these conditions, however, and the massive profits earned because of them, "the war contributed to laying down the foundations of the most secure future for our industry." [24]

The consequences of the facility with which industrial products were manufactured and sold during the war were only felt in the immediate post-war years as the very grave problem of overcapitalization. When the peace "broke out", "the colossal mechanism of war-time industry continued to turn, aimlessly, without being braked, incapable of deviating its energies rapidly towards new fields of activity." [25] At the time of writing, Corbino stated, the world was locked in "one of the gravest crisis in world history," and Italy was spared the worst of it only because of favorable exchange rates.

Referring specifically to the "anti-industrial mentality", the preference for secure state titles and fear of industrial investment, particularly with regard to the electrical industry, Corbino asked if there was so much money to be made in this industry, if electricity entrepreneurs were such speculators and "thieves," then why did not everyone not invest in this sector? The flight from this industry in particular, even hostility to it, he felt, was largely due to its being "by nature" a monopoly, which led people to assume that the corporate form would be used as little more than a price fixing mechanism. Further, aversion to investment in this sector could, to some degree, be ascribed to the simple fact of electricity being "such a mysterious product." [26]

Before the war, Corbino pointed out, it was very much an uphill climb to encourage diffusion of electrical energy. To obtain permission from local comunes to lay out power lines, lighting systems had almost to be offered free of charge, and prices of electric motors had to be dropped below cost to tempt industrial consumers into adopting them in manufacturing. As a result, a bizarre system of differential tariffs came into being, in which there was one price for lighting, a different one for industrial power generation, special prices for hotels, coffee bars, shops, cinemas, and illumination for advertising.

The war, however, forced radical change on this situation. With very high coal prices and supply routes precarious, electricity no longer had to struggle to win the energy market away from traditional competitors. "The electrical industry was left 'padrone' of the field." [27] Despite the war-time elimination of competition for electrical power generation, however, an additional difficulty appeared to block expansion in this sector. The utility industry had become the "servant" of all the heavy manufacturers mobilized for armaments production, industries which could almost arbitrarily increase the prices of their products, while electricity producers were still tied to earlier contracts or conventions or tariff restrictions. [28] Corbino admitted that the quantity of energy sold annually increased by 50% during the war, but maintenance, operating costs and expansion of plant expenses rose accordingly.

In addition, increased demand for electrical energy could not be met, as the demand for housing could not be satisfied, because of high post-war construction costs. And at the same time, because of the low selling price of energy in relation to the devalued lira, there was tremendous waste of resources and inefficient employment of the technology available. On the implications of this type of inefficient industrial configuration, Corbino conculuded with a warning: "In the changed conditions of the energy market, in which demand is greater than supply, there is no doubt that the monopoly

situation created in favour of the electrical companies constitutes a possible danger for the future." [29]

For Corbino, all these points taken together - financial, technical and legislative - formed a picture of an economic system whose technological base was racing ahead with the same tenacity that the social and institutional framework was determined to remain static. The global result was an "anti-industrial mentality," which not only dangerously contradicted trends in the international economy, and would have grave consequences in securing competitive advantage for Italian producers at that level, but the institutional backwardness which was both cause and effect of this mentality also stood in marked antagonism to what was happening on the technological level within the country itself. In the end, the choice was clear and categorical: "If one accepts a system founded on private property, one cannot refuse the defence of industrialism." [30]

Of the multitude of structural obstacles cited by Corbino which blocked the formation of an "industrial spirit" in Italy - through the mating of science with industry and the formation of the technically prepared managerial personnel consequent to it - the question of long term financing and legal and fiscal reform highlighted by the future fascist minister was perceived as one of the most urgent, and the organization of industrial finance should be examined a bit more closely. This will be the concern of the next section.

The Problem of Indigenous Financing

Prior to the war, the problem of indigenous financing for scientific research and industrial modernization was firmly impeded by the dominance of foreign direct investment in Italian industrial projects. Rail development, for example, had been financed by the Rothschild and Periene banks of Paris, and the network was foreign managed and equipped. [1] In the electrical power generation sector, as mentioned, the Edison system of lighting had been brought to Milan in the 1880s as a total technological package. This was, in a certain sense, technology returned to Italy, since the key to transmitting long distance current - the alternating current motor, based on the principle of a rotating magnetic field - had been discovered by Galileo Ferraris and reached Edison through the purchase of a patent taken out by Nicola Tesla in the United States. [2] According to Roberto Maiocchi [3] a superior lamp filament had already been discovered in Italy by the amateur inventor Alessandro Cruto, who had been looking for a way to produce artificial diamonds, and instead came up with a very pure graphite. The important point, however, is that Cruto was not only competing with a different type of lamp filament, "but with a huge company, capable of furnishing a complete system of illumination, from the generator to the lamp itself." [4]

The financial, legal, educational and institutional structures, however, not having evolved in step with the highly complex systems imported en bloc, ensured that the requisite social structures were lacking to make the technology a component of a larger self-reproducing system of production. In fact, the very complex question of financing for this industry would persist, until the establishment in June 1925 - on the initiative of the minister of Finance and Venetian industrialist, Giuseppe Volpi - of the special Istituto di Credito per Imprese di Pubblica Utilità. A year later, this institute would in essence become the distributor of industrial credit

issued from American banks to a select group of Italian electrical companies, an operation mediated by Thomas Lamont of the Morgan Bank of New York. [5] The credit institute was to be limited to financing up to 50% of any given development project, and "for the new institute special fiscal measures (were) planned which will make dealing with it preferable to any direct issuing of titles by the individual companies concerned." [6] Shares were to be quoted on the New York stock market, and, as L'Elettrotecnica took care to specify, American shareholders would deal exclusively with the Istituto di Credito and not directly with the firms involved. This was to guarantee that the Italian companies would be free "of any danger of foreign interference." [7]

The establishment of such an institute of industrial credit for the electrical industry had been proposed earlier in 1919, by the parliamentary deputy and electrical engineer Paolo Bignami, who had also been under-secretary at the Ministry of Arms and Munitions during the war. [8] Bignami's ideas were the focus of some controversy immediately after the war because of an article of his that appeared in the journal L'Elettrotecnic in 1919. In this intervention, after analyzing the inefficient load factor registered in energy production and distribution in Italy, Bignami proposed massive state participation in establishing an "electrical bank" to finance the completion of a power network, increase the load factor, and lay out a comprehensive plan for energy exploitation and national economic development. This specialized credit institute, according to Bignami, would judge the development of suggested projects and applications for concessions on technical criteria alone. By doing this, the post-war problem of overcapitalization because of the easy availability of credit could be controlled. Indiscriminate extensions of industrial credit by the mixed banks, "business", would be curtailed by this special state institute that would perform this function according to criteria of technical efficiency. [9]

Bignami's scheme was intended to alter the relationship between the banking system and industry, as it had evolved during the years of most rapid industrial growth between 1896-1914. The increasing importance of the banking system in issuing industrial credit during this period was itself in part due to foreign investment in Italian industrial development:

> Although Italian exports increased throughout the period from 1896 to 1914, imports grew even more rapidly. Consequently, Italy had a continuing and rising trade deficit. It was financed in part through immigrant remittances, but primarily through direct and indirect foreign investment in capital equipment, and through the creation of foreign subsidiaries in Italy...it appears that the bulk of increased foreign investment occurred in and through the banking system. [10]

The trend towards the increasing presence of the financial system in industrial activities had begun around 1880, and was greatly intensified towards the end of the century. In particular, the banks assumed an increasingly important role in the intermediation process, "attracting funds from savers and directing them toward ultimate investors." [11] By the time of the Italian industrial "spurt", the industrial credit banks were the major source of financing for industrial investment schemes:

> Almost all firms that expanded between 1894 and 1914, and all the major ones founded during these years, relied on one of these financial institutions for capital and other credit services. Many of the banks' activities do not appear in their balance sheet data: they were major underwriters of new security issues; they assisted firms in transforming themselves into joint-stock companies; they provided technical advice on new technology and frequently played an entrepreneurial role in organizing a group to form a new company under their auspices and with their assistance. For example, the electric power industry developed almost exclusively under the tutelage of one of these banks, the Banca Commerciale Italiana...[12]

This was a radical turn around in the relationship between the financial system and industry. Until this period banking investments had been primarily in real estate and construction speculation, on account of the high risks associated with industrial investment, given the relatively low output of the industrial sector of the economy. The situation was

not changed by efficiency improvements in industry, but by the centralization of the banking system in 1894 with the creation of the Bank of Italy:

> With this act the government supplied the banking system with a true lender of last resort and the country with a well-regulated, sound money supply. The government also thus created a new policy instrument to control national economic activity...Given the tendency of the major investment banks to hold portfolios with a high percentage of industrial assets, they were unable to withstand even the minor panics that frequently accompanied economic crises...The existence of such potential support (thus) reduced the risks of holding portfolios containing a large percentage of illiquid industrial assets, and thus permitted the banks to pursue ambitious industrial credit policies. These actions by the Bank of Italy had the salutary side effect of bolstering public confidence in the banking system and thereby encouraging the flow of personal savings into deposits with the banks of ordinary credit. [13]

By 1924, however, when the first debates began among business leaders in the fascist Higher Economic Council, the dominant complaint would still be the absence of public investment in industrial securities, and investors still seemed to prefer the less risky road of government securities.[14]

This is some of the background to the engineer Paolo Bignami's proposal for the establishment of a credit institute specifically for industrial development projects in the utility sector, to be staffed by technically qualified personnel whose investment decisions would be based wholly on an assessment of the technological integrity of the projects submitted. Realizing such a project, and the entire question of drawing investors to the electrical industry, was very much complicated by the technical structure of the industry itself - in part a consequence of the historical relationship between the financial system and the industry - and the question of financing should not be isolated from the relevant technical problems. An attempt to examine some of these problems will be made in the following section.

The Non-Integration of the Power Supply Network

In considering the question of efficiency in electrical power generation, the term "load factor" must be immediately introduced and defined, "the most important detail after capital cost in producing economical results." [1]

Introduced by Crompton in 1891 to measure the influence that the relationship between production of energy and the value of potential maximum demand had on costs, load factor was calculated as "the ratio of the actual units generated in any given time to the units which would be generated were the plant working continuously at full load during that time." [2] The price of kilowatt/hour was represented by the formula:

$a_1 = \frac{\alpha 1 \; d_1}{u} + a'_1$ in which $\alpha 1$ equals the percentage of capital d_1 relative to fixed costs - i.e. interest, depreciation, maintenance and fixed operating costs - and "u" equals utilization in hours, and a'_1 corresponds to costs proportional to energy produced, such as fuel, lubricants, maintenance materials and personnel expenses. Clearly, increasing the value of "u" - the number of operating hours - would diminish the percentage of fixed capital costs. [3] The wider the range of the supply network, therefore, the more efficient the load factor. This is particularly important in the case of hydraulic power generation, since the cost structure of the industry is characterized by a high incidence of fixed capital expenditure.

Before outlining the complex story of the development of this industry in Italy - and its "failure" from a systems or efficiency point of view, resulting in the usual financial manouverings, and thus a heightening of the corporatist reformism that was both complement and dialectical opposite of this "business" behavior - the salient points of the process should be summarized.

As Renato Giannetti pointed out, the production of electrical energy is particularly sensitive to the problems of location and availability of resources, and the configuration of an electrical system depends on a number of factors:

1) the nature of technology available
2) location of specific natural resources (including the topographical conditions and patterns of precipitation)
3) distribution of population and industry, which explain the quantity and composition of demand for electrical energy.[4]

In Italy, in contrast to the process of development of this industry in many other areas, the lack of coal deposits and availability of hydro resources encouraged a precocious specialization in the thermal use of electrical energy, and heavy investments in the production of iron and steel with electric furnaces. The dominance of this form of power generation encouraged industrial consumers to install their own generation plant, rather than purchase energy from a centralized authority or national electricity network, and the construction of an integrated power supply system was tenaciously blocked during the inter-war period. Economies of scale, therefore, normally a typical characteristic of this industry, were only minimally diffused in the sector in Italy during this period.

In particular, the efficiency of the industry was seriously undermined by the various forms of transmission adopted. Energy price reductions for final consumers and the possibility of implementing radical changes in the structure of the industry in conformity with fluctuations in demand, were blocked by construction of distribution systems on a regional scale. Energy production was conceived in local terms, and transmission systems were designed to provide energy exclusively to local producer goods industries. The technical structure of the energy sector, therefore, was laid out in such a way as to considerably debilitate one of its most important potential advantages - the almost infinite divisibility of

energy use, and the possibility of choosing how, where and when to utilize energy to effect the specialization demanded by individual processes and products. The engineering industries and domestic households were therefore the least developed consumers of electrical energy between the wars in Italy, end users which normally function as an important means of allowing for a more efficient utilization of capacity.[5] The inflexible and inefficient technical structure of the energy producing sector thus created more space for profit maximization through financial manouvres - "business" - and government intervention to protect investments, rather than make the sector more attractive to investors by increasing the efficiency and technical integrity of the power producing industry as a whole.

The details of the question were contained in a report submitted to the Consiglio Superiore dell'Economia Nazionale on the fourth of February, 1926 by the electrical engineer Guido Semenza.[6]

In his report, Semenza began by referring to the most basic problem in electrical power generation: how to rationally deploy the surplus energy produced by hydro resources. Efficient employment of surplus energy could only be approached by adoption of connections between different networks and power systems, and the problem of the rational transport of energy depended essentially on effecting these connections between systems.[7] The overall problem which rendered the transmission of energy a complex one emerged, in the last analysis, from the divergence between the flow of hydro resources and patterns of consumption of electrical energy. Considering sources of supply first, Semenza observed that the hydrology of Italy varied greatly from one region to another. The Alpine chain produced considerable volumes of water, but only in summer when the ice melted. Appenine flows, particularly in the Abruzzo and Terni areas were also significant, but only in spring and autumn, being rather more

scarse in winter and almost non-existent in the summer.[8]

On the demand side, there were both daily as well as seasonal variations to consider. The eight hour working day required energy only 30% of the time and nothing during holidays. Energy demand for illumination was seasonally strong seven or eight months per year, but only for a few hours daily. Moreover, there were only a few industries or services which were continuous energy consumers, such as the railways for electric traction.[9]

Energy surplus could therefore be divided into two categories: "residual energy", which was the quantity of surplus energy dependent on daily variations; and "surplus energy", which was defined as that which for long periods (i.e. seasonally) greatly exceeded consumption. In general, the most serious defect of electrical energy generation was its unsuitability to being accumulated without being transformed, and only minimum quantities of potential electromagnetic energy could be contained statically. From this it followed "that the production of electrical energy is fatally subject to the hard servitude of adapting itself continuously to variations of consumption."[10] And because the cost structure of the energy producing sector (a heavy incidence of fixed capital expenditure) could not allow for massive amounts of surplus energy to be produced because of daily or seasonal falls in demand, "it very quickly became apparent that the economic solution to the problem consisted in the linking up in parallel of an ever larger number of power centrals, to profit from the inconsistencies (of supply and demand)".[11]

The economic importance of resolving this problem was also emphasized by the editorial writer in Politecnico, who pointed out that 1 horsepower of energy produced electrically represented an annual saving of three tons of coal, 100% of which had to be imported to power Italian industry. The problem of energy surplus was therefore a very grave one, and required the maximum of cooperation, coordination and planning:

> The economy of an electricity central does not depend only on the output of the various machines, but equally on the way they operate together, and particularly, on the uniformity of the load. Boilers, for example, that furnish steam for only short periods of time are anything but economical. One need only think about the quantity of heat needed to heat water - the metallic parts, the walls of the boiler, and so on - heat that is then lost when the boiler shuts down. [12]

It was therefore of prime importance to eliminate the production of surplus energy, by integrating transmission networks, balancing production and consumption, and realize a more efficient load factor.

At this point it would be useful to step back a moment and consider the international dimension of the question, oligopolistic competition at the international level in part defining the terms of the problem in the first instance.

In Italy after 1900, the development of the electrical industry followed very much the pattern established by international competition between German, Swiss and American producers of electrical energy and electrical engineering equipment. In particular, in pre-war Italy "the German presence was crushing, both qualitatively and quantitatively." [13] The two most important firms concerned, which dominated most of the European market for electrical engineering equipment, were Siemens and Halske and the Allgemeine Elektricitats Gesellschaft (AEG), founded by Emil Rathenau to exploit the Edison patents in Germany. From two statistical surveys conducted by the Italian Ministry of Agriculture, Industry and commerce in 1898 and 1908, it resulted that during this period the total number of electrical generators of foreign origin operating in the peninsula was never less than 70%. [14]

The dominance of German electrical technology in pre-war Italy did not, however, lead to the construction of a centralized and integrated supply network, largely because of the easy availability of hydro resources for industrial exploitation. A power supply configuration was therefore favoured which accommodated small "self-producers" of industrial energy. Of the many power generation plants that appeared before world war I -

particularly to furnish energy for small scale textile and paper factories - most were designed with very low rates of utilization of capacity, canalization was undertaken to serve only local needs, and often varying frequencies were employed. Between 1885 and 1910, electrical generation plant installed in Italy was limited to exploiting only 23-25% of available hydro capacity. [15]

From 1910 the sector began a period of expansion, largely due to technical improvements in turbine construction, which did not lead to the installation of more power centrals, rather to the increase in capacity and scale of a very few of those already existing. To cover costs and increase the efficiency of the load factor, the large producers were pushed to try to group hydro concessions around the larger centrals, using the smaller producers that were absorbed to act as a buffer to cover fluctuations in demand. The competitive configuration that resulted came to be referred to as "the parallel wars", and involved nine central industrial groups: the Società Idroelettrica Piemontese, Edison, Adamello, Adriatica, Unione Esercize Elettrici, Tridentina, Elettricità e gas di Roma, Ligure-Toscana e Valdarno, Meridionale di Elettricità. It was between these suppliers and the large scale industrial "self-producers" (Ansaldo, Breda, FIAT, etc.) that battles were fought out over concessions. [16] The war provided the background to these initiatives, and the result was the fragmentation of networks, concessions and frequencies with the state acting as the battlefield to be conquered and provider of favours to competing interests.

As Sergio Romano observed, these struggles represented "two equally plausible versions of capitalist development: horizontal and vertical," the advocates of a single, integrated power network representing maximum vertical integration in the name of technical efficiency, the industrialists such as Ansaldo's Perrone brothers feeling threatened by the economic power

of those who controlled energy supply, and advocating horizontal specializatic of production. [17]

During the war the economy had expanded to a point where these contrasts would be inevitable, and the state attempted to arbitrate "by agreeing with industry while not disagreeing with the utility companies." [18] In order to maintain production levels, minister of Public Works Bonomi had a law passed in September 1916, which offered hydro concessions to industrial metallurgical and chemical producers, provoking the hostility of the utility interests, and further increasing the horizontal specialization of the industrial structure and compartmentalization of the energy supply network. Large iron and steel producers - Terni, Ansaldo, Ilva, etc. - made the greatest gains, applying to the state for development of a total of 1,700,000 kwh of electrical energy for industry between 1917 and 1919. [19]

This investment strategy was also encouraged by fiscal concessions, whicl freed industry from taxes on war profits if earnings were used to invest in developing hydroelectric capacity. [20] The same was true for investment in merchant vessels, if the sum invested was four times that of the tax total to be imposed. In a very real sense, therefore, the massive investment in and industrial consumption of electrical power from 1914 to 1922 (consumption increased 165% during this period) [21] was - just as the entire conception and construction of the naval shipyards of future finance minister Volpi at Porto Marghera in Venice - "a gigantic fiscal evasion." [22]

The compartmentalization of the energy supply network and tendency to horizontal specialization was also manifest in the conception of energy tarif policy, which, from the time of the debates on the Bonomi decree in 1916, was formulated exclusively in financial rather than technical terms. That is calculation of energy prices was based on fixed plant costs, rather than on the variable relationship between marginal costs and price. [23]

The post-war fall in demand, combined with inflation, which allowed for easy payment of debts but did not compensate for loss of value of capital stock, revived pressures for increases in energy prices, and a 50% increase was permitted by government decree in March 1921. According to the electrical engineer Domenico Civita, writing in 1922, total costs (personnel, operating expenses, interest, depreciation) in the energy sector had more than quadruple since 1914, receipts covering only 16% of investment, and a 140% increase in price from 1914 levels would have been required to meet costs. Due to the eight hour day and higher wages, personnel costs alone had risen six to eight times above the pre-war level, increasing from 5 to 14% of total operating expenses.[24]

Essentially, these were problems caused by the race for spoils during the war, and inefficient technical organization of the industry to allow for more flexibility in responding to falling demand. In addition, financial difficulties were fed by Giolitti's post-war measures which revoked abstention from taxes on war profits for large industrial producers.[25]

By 1922, therefore, the problem of investment funds, because of falling share prices in the energy sector, was again raised; and, further, the technical structure of the industry was left fragmented and unintegrated, with systems in Liguria, Lombardy, Piemonte, Emilia and Veneto employing frequencies ranging from 100 to 250 volts.[26]

Despite this not particularly sanguine picture of the energy industry, however, by the time of the fascist seizure of power, the energy sector could profit from the general rise in the level of aggregate demand (primarily for metallurgical, engineering and chemical products) to attract investment funds. The dynamic components of this process were: a buyers' market for labour (already weakened by the fall in prices and unemployment increase of 13% in 1921, and the restrictive U.S. immigration policy of the same year); easy credit conditions, and increased world demand for manufactures.[27]

The period 1922-25 constituted the years of greatest industrial expansion of the inter-war period, but growth was founded wholly on increases in investments and trade, not domestic consumption. The particular characterist of fascist political economy was to render the wage variable exogenous, throu direct control of the labour market, and this feature of the economy in the period of most rapid growth is reflected in a few aggregate figures: in these four years, while monetary value of manufactures increased by 18.4%, unemployment rose 6.2% and the wage bill only 4.7%. [28] The industrial structure was therefore rendered particularly sensitive to fluctuations in world demand, and variations on foreign and domestic capital markets. And the inherent weaknesses of this economic configuration were both mirrored in the renewed presence of the banking system in industrial speculation, and masked by a series of fiscal measures introduced by the fascist government. Almost immediately after taking power, the fascists abolished a 1920 law which had made identification of all shares quoted on the stock market obbligatory. [29] In addition: the February 1918 legislation which had established the tax on incomes of administrators of share holding companies was revoked in January 1923; the same was true for managers and attorneys of joint-stock companies; the tax on dividends issued on private and government titles was abolished in July 1925; finally, the complementary tax on incomes higher than 10,000 lire was eliminated in December 1923. [30] These measures were consistent with minister of finance Alberto De Stefani's policy of freeing capital for investment, but the technical organization of industry continued to be characterized by inflexibility and instability, and its financial solvency depended on market conditions prevailing outside Italy, and on the domestic repression of labour.

As argued here, the conditions of the electrical industry contributed significantly to the development of such a political economy. Returning to

Guido Semenza's 1926 report to the National Economic Council, a policy was advocated of constructing conversion stations to connect up the numerous networks and frequencies operating in the various regions, as opposed to a program of installing a single system of centrals, using a standard frequency based on the American model. [31] This was essentially the system which had resulted from the inter-regional link ups during the war, and involved energy exchanges between the Ligurian network (which itself operated on three different frequencies - 50, 42 and 16 cycles/second); and Piemonte, which generated power at 50 cycles/second, connected by converters which allowed for exchanges of energy at 16 cycles/second by means of electrical rail lines. This system could in turn be connected with the network in Lombardy, functioni at 42 cycles/second, by conversion stations at Dalmine, which fed energy to Emilia at 50 cycles/second through converters at Ozola. Similarly, energy produced by Giuseppe Volpi's SADE in Veneto fed the Adriatic coast until Rimini, where a 42-50 cycles/second conversion station provided energy to the Marche. [32]

The construction of such a system was costly and complicated, and was perceived as a consequence of earlier rivalries between foreign suppliers of power generation equipment who protected themselves against competition by installing a variety of tensions and frequencies. [33] Semenza argued that seasonal variations in the availability of water according to region determined that such energy exchanges would be necessary. The problem, however, was that since the brief periods when energy would be exchanged would be very intense, maximum capacity lines would be required, and therefore considerable capital outlay. This problem proved to be crucial in this sector, and led Semenza to lament "that the concepts we have referred to here have not been widely diffused and understood, and, spokesmen as we are for the union of science and industry, we would like to see not only science informing industry as regards production processes, but also in areas relating to economic problems of a higher order." [34]

The fragmented energy system that emerged - using low cost hydro power to service localized industrial requirements - encouraged production of low value added products, strongly dependent on low energy prices (calcium carbide, calcium cyanamide, iron alloys, etc.) which further impeded rationalization of energy supply and vertical integration of the industrial structure.[35] From 1920 to 1940, only four products - alluminium, calcium carbide, calcium cyanamide, and nitric acid - absorbed from 12.7% to 69.9% of the total surplus energy produced by electricity centrals.[36]

The absence of an efficient level of vertical integration in manufacturing and low production levels in manufacturing as a whole, in part due to the nature of the energy supply system described above, was a problem illustrated by the development of the aluminium industry in inter-war Italy. Lacking the mineral and coal deposits necessary for a strong heavy metals industry, the appearance of light metals such as aluminium on the technological horizon was naturally received with enthusiasm by technical reformers as an alternative process and product for Italian industry. Aluminium, the engineer Arturo Paoloni declared in 1925, will be the "white iron" of the future, just as electricity was the "white coal" of the present.

World production of aluminium had almost tripled between 1913 and 1924, from 68,200 tons to 184,550 tons, expanding in step with the energy sector itself. The unquestioned leader in the field, in both production and consumption, was American industry, producing 85,000 tons of the 1924 total, and consuming more than half of world production of this metal for the U.S. automobile industry.

Hydroelectric potential in Italy, however, seemed encouraging for the development of a competitive aluminium industry in the peninsula. Again Switzerland provided the model, which, though not possessing bauxite for the chemical preparation of alumina, could import the semi-finished material from Marseilles and, using the considerable hydro resources available, transform alumina through electrolysis into the finished metal.[38] The weak point

in Italian production would be in the preparation of pure alumina with bauxite. With the annexation of Istria following the war, Italy now had claim over bauxite deposits but processing required large amounts of coal. In 1925 there were only two producers in Italy, the Società Italiana di Elettrochimica in Bussi, and the Società dell'Aluminio Italiano in Borgofranco which together manufactured only 2,000 tons of the new metal. [39] An increased substitution of electrical energy for coal, particularly in the mid-1930s as part of the "autarchia" campaign, greatly increased capacity in the industry but there was no effective coordination between aluminium production and end users in the engineering industries, and for the most part production was exported, particularly to Germany. [40] Not until 1937 was the Istituto per lo studio dei metalli leggeri founded, by Montecatini, to determine standards and characteristics of semi-finished light metals, and coordinate the industry with industrial consumers of aluminium. [41]

Having been organized as a discontinuous system of energy supply, generating electrical power for localized industrial interests according to unregulated seasonal surpluses rather than on a continuous, regular basis for maximum efficiency, the interests of the electrical energy industry - one of the most scientifically "rational" of modern production techniques, whose "work unfolds uniformly and scrupulously preordered" [42] - served in fact as an important brake on the development of a more specialized and vertically integrated industrial structure. The integrating function of thermal power centrals, more flexible in responding to demand fluctuations than hydro centrals, was neglected by the dominant interests in the Italian energy supply industry. Such a systematically inefficient investment strategy clearly testified to the overwhelming dominance of this sector in the inter-war economy, whose percentage of the total share capital of Italian industry passed from 9.24% in 1920 to 22.19% in 1935. And the Edison group under the direction of Giancinto Motta, one of the engineer-entrepreneurs graduated from Milan Polytechnic during Colombo' presidency, controlled well

over half of this share capital. [43]

The speculative nature of the dominant energy supply strategy in the economy of fascist Italy is brought out in looking at the production of iron and steel using the electric furnace during this period. In general, production was carried out in relatively small and dispersed plants, utilizing unregulated surplus energy produced by hydro centrals. Costs were thus kept down, but at the expense of a greater output. For example, to fuse steel, 350 kwh are in theory required, and 100 kwh subsequently for refining - that is, a total of 450 kwh of power for the production of one ton of steel. In Italian plants, energy consumption exceeded 800 kwh for the production of one ton of steel (1938), which could have been reduced by perfecting manufacturing processes and modifying the energy supply system, solutions, however, to which the powerful utility companies were less than amenable. [44]

To conclude this section on the energy sector, the related problem of transportation and communications needs to be looked at in some detail, and warrants consideration in its own right. Looked at overall, and despite all the reformist optimism about "white coal" for its inherently rationalizing and liberatory potential from old technological models - and in an economic culture particularly sensitive to reformist programs based on technological initiatives, the end result was essentially more of the same: fragmentation, inefficiency, lack of coordination, economic "individualism" and speculation. Promising rejuvenation in society and politics because of their intrinsic nature as integrator, coordinator and rationalizer of social resources, technological instruments in the economy of fascist Italy ended by functioning as new means with which to conduct old activities - "business". The tensions produced by the merging of the old and the new to generate more of the same, in an area scarcely endowed with industrial resources and therefore predisposed to conceive social reform in technological terms, emerged at the political level to inform and contribute to the formalized vision of harmony and

order that was corporatism.

Transportation and Communications in Inter-war Italy

In a 1923 essay written for the journal Elettrotecnica, the electrical engineer Marco Semenza made the following observation: "the english motto 'time is money'...expresses succinctly the inexorable tendency...that our civilization has followed during the period of its greatest flowering - from the beginning of the nineteenth century to the outbreak of the first world war." [1] Not immoderately, it was affirmed that the progress of industry, sophistication of the means of transport and communications, and scientific exploitation of natural resources had been due to this pressing need to act on the axiom "time is money". [2] "It is to the conquest of time", Semenza argued, "that man has directed the progress of civilization." [3] This "conquest" had assumed two historical forms: the first was mechanization and increasing capitalization of the production process; the second was to diminish time loss by elaborating the accessory services needed by the process of mechanization. The first step, the author explained, required the "inventing spirit", the second demanded "the spirit of the organizer". [4]

In the Italian system of transport and communications, and particularly in the railroad system, Semenza lamented, this "axiom" of rational business behavior had been consistently violated. The policy of the government had always been to reduce traffic to a minimum through a complicated and uncoordinated tariff policy, and by suppressing link ups between lines and schedules. This criticism applied to both freight and passenger trains, and the ultimate consequence was that "rather than a boost, the rails represent a brake on the progress of the nation." [5] Abuse of the railways as a public service was "inherent in a system of monopoly" by the state, and

changing this situation would have to be taken into serious consideration in any public service reform effort. As far as privately owned rail lines were concerned, Semenza insisted that once they were freed from any legislative intervention by the state, "the free forces will know how to find a way, as always, to reconcile their own interests with those of the public." [6]

The communications system of telephones, telegraph and post office - "the means of communication which, together with the railways, are the basis of the organization of modern civilization" - were little better. [7] It was not possible during busy hours to make more than three or four telephone calls per hour, and limiting reform to simply cutting back on personnel, without major investments in improving and expanding the technical base of the system, was not sufficient. The most important overall consequence of this picture of inefficiency and neglect in transport and communications, the engineer insisted, was not so much its contribution to creating a severe budget deficit. The problem, rather, lay in its impact on "missed business opportunities". [8]

In Italy, reform of the system of communications, and in particular of the railroads, was the logical framework for an efficiency model to be hacked out for the political sphere. Performing an essential role in economic development, the transport sector had also been traditionally the "industrialized" sector of political management. In general terms, Patrick O'Brien has described the economic function of transportation in development:

> Freight costs declined (with transport innovations) not only because the volume of real resources...required to transport a ton of commodities over a given distance decreased, but also because innovations like steam propulsion meant that commodities could be transhipped with far greater speed and continuity, which implied a greater utilization of the capacity employed in transportation. For transport users the increased speed, regularity and reliability of delivery reduced losses on goods in transit and obviated the nee to hold large stocks of finished or intermediate goods as a precaut ion against irregular or slow deliveries. Thus as their storage and inventory charges per unit of output declined, producers could transfer investible funds from circulating to fixed capital.

> Above all, more efficient transport technology reduced the costs of fuel, raw materials and construction materials to industry and agriculture and enabled industrialists and farmers to sell their products to consumers at lower prices...(Moreover) more efficient transport helped to break down geographical and social barriers to competition. Competition in turn assisted in the diffusion of improved technology and pushed producers towards higher levels of efficiency...Furthermore, the improved transport systems themselves also widened markets because they made direct demands for inputs upon several other industries...New transport systems also made voracious demands for funds which brought about improvements to the institutions and techniques of the capital market...[9]

The transportation sector was therefore a natural field of collaboration between private and public spheres, the productivity and efficiency of the one being dependent on the careful organization of the other. In a November 1926 meeting of the National Economic Council in Rome, following a report on rail tariff policy by the engineer Raimondo Targetti, Senator Pirelli pointed out as much:

> the impression is that the railway administration is sealed off and isolated from everything else, and the economics and foreign ministries, as well as the larger interest groups, cannot make their voices heard or have their views considered. I believe, rather, that it is a hospitable place where we are occasionally invited to express our opinions.
>
> What is missing, however, is a consistent collaboration between industrial representatives and the rail administration. More than isolated measures are required...an agreement for a daily and continuous collaboration between such groups and the adminstration is necessary...[10]

By "collaboration", "concessions" were clearly intended, and Pirelli praised as a beginning a decree of October 1926, which authorized the director general of the railways to concede tariff reductions on freight transport when it was felt to be "urgent for the development of industrial commerce." [11]

To appreciate the importance of the problem of transport in fascist Italy, and in tracing the trajectory of corporatist pressures acting to make this sector a major source of tension in contributing to the conceptualization of reform, it is first necessary to consider some of the technical features of the system.

The two basic problems to confront had been offered by nature: mountainous countryside, requiring expensive tunnel construction; and the

dearth of coal. A full 30% of all coal imports was consumed by steam locomotives in Italy as late as 1925, the greatest quantity of which came from Great Britain. [12] The problem of fuel costs in particular raised the question of electrification of the system to a level of prime importance. According to figures reported in the journal Elettrotecnica of 1924, it cost 3,908 lire/kilometre to run a steam locomotive, as against 120 lire/km. to operate on a tri-phase electrical line. [13]

The second significant problem with steam locomotives, in particular as concerned passenger trains, was that since there had to be so many tunnels in the Italian system, there was a real danger of asphyxiation if two trains passed through a tunnel a few minutes apart, not giving the air inside time to clear. [14] Thus the question of an electrical "system" arose again, the choices being the tri-phase, monophase, or the American system of continuous current.

Unlike most of the rest of Europe, which operated on the monophase technology, by 1920, and under the general management of Riccardo Bianchi at the railway administration, almost all Italian rail lines that had been electrified - and by this point there were in fact very few, totalling only 720 kilometers - used the alternating current system. This effort had been principally concentrated on short lines around the port of Genova, which was the type of traffic most suitable for the tri-phase system. [15]

During the war, the combined need to move large numbers of men and materials to the front, and the slow down in British coal imports, had encouraged experimentation with locally available lignite and wood, but more importantly gave the decisive push to extending the tri-phase network. [16] Immediately following the war a government project was approved to electrify 6,000 kilometers of the rail system, and the question of the appropriate technology to adopt again became a matter of immediate practical concern. [17]

Not surprisingly, Marco Semenza, who had lamented the "missed business opportunities" caused by inefficient transportation in Italy, was quick to intervene in his capacity as an electrical engineer. [18] Having made the more general point earlier that post-war economic conditions demanded technological uniformity at an international level, Semenza applied himself to a specific critique of the wide-spread use of the tri-phas system in Italy, observing that no other rail electrification system in the industrialized world employed alternating current technology. His condemnation was total: "...no other railroad administration has adopted the motor that is least appropriate to traction service - that is, the tri-phase induction motor." [19] In the United States continuous current technology had been universally applied, and in Germany and Switzerland the monophase system was in operation. According to Semenza, the American system was both more convenient and cheaper to maintain. The weakest feature of the tri-phase network in use in Italy was that good service required a power sub-station every 8 to ten kilometers. If this distance was increased, the tension dropped significantly, as had been demonstrated on the Ronco-Turin line. [20] Moreover, if a sub-station broke down the traffic would be interrupted on the entire piece of track fed by the station. At least with steam locomotives, if an engine was damaged it did not affect the traffic on the whole line. [21]

Similarly, the advantages of the continuous current system lay in the fact that if the tension drppped, traffic would slow down but locomotives would not stop, as in the system of alternating current. Indeed, with motors in series using continuous current, the traction force and torque would increase as the tension diminished. [22] In addition, the complicated nature o tri-phase technology presaged a good deal of lost time for equipment maintenance, and the slowness, irregularity and inefficiency of the already existing system of steam locomotives would not be improved upon by further use of the alternating current motors.

The traction engineer and technocrat Pietro Lanino - whose social reform prescriptions represent the most systematically developed statement of technocracy in the Italian engineering literature, and will be looked at in detail later -disagreed with Semenza's assessment, making a more nationalistic appeal. [23] Italy, Lanino claimed, was one of the world leaders in developing tri-phase equipment which, unlike the American system, was not subject to monopoly. " We are the eternal destroyers of ourselves," Lanino wrote, "in politics as in industry...(Now) our government sends a commission to Paris to hear what French engineers think about Italian electrical traction." [24]

Characteristically, a vigorous reform debate on technological options developed in parallel with the absence of active initiative. Reflecting related problems in the construction of a national power network, a unified traction system was never laid out during the fascist years, and by the late 1920s a complicated and fragmented network had been settled upon, the continuous current system being installed south from Bologna, and a tri-phase network was to the north of the capital of Emilia. [25] This meant that locomotives travelling north-south had to be changed at mid-point because of incompatible systems, with obvious consequences for efficiency and time loss, and presented yet another obstacle to the social and economic unification of the peninsula. [26]

In any case, by 1928 only 8% of the state run sector of the railroads (only local secondary lines were privately operated) had been electrified, and ten years later, on the eve of world war II, this figure had little better than doubled. [27]

Important reasons for the lack of innovation were the relatively low volume of traffic on the railways, and minimal competitive pressure coming from the automotive sector. To take the first point, fixed costs in rail transport formed up to 70% of total expenses, a burden which could only be overcome by increases in the volume of traffic. [28] Any notable reduction in

traffic therefore compelled tariff increases which, in the absence of measures to reduce operating costs, resulted in a further decrease in traffic.

As regards the second point, in theory road transport could furnish the competitive push to cost reduction innovations in rail transport, but in the highly localized industrial landscape and undeveloped domestic market, this was not the case. The competitive advantage of road transport lay primarily in the time savings of door to door transport - loading and unloading costs were minimal and much less time was lost in the actual movement of goods. [29] This advantage, however, tended to diminish with increases in the distance to be travelled, the maximum point being reached in Italy at about 100 kilometers. [30] Therefore, although rail costs had increased six times between the outbreak of the war and 1927, pressures to reduce costs through investment and innovation were only seriously felt on very short distance lines, operated largely by private interests, connected with or identical to local industrial proprietors. [31] The entrance of automotive competition for short distance transport is reflected in the fact that in 1926-27 the average distance for freight transport in Italy was 190 kilometers, a good deal of the movement of goods under that distance being effected by local truck transport. [32] In contrast with the figure of only 8% of the long distance state network of railways having been electrified by 1928, 25% of local privately run lines had switched over from the costly coal operated locomotives by the same date. [33]

As far as private automobiles were concerned, the lack of road development seriously hindered the expansion of a domestic market for private vehicles, as did the costs of licensing and petrol, which raised the price of a car to at least double that of American prices. [34] In 1917 there were eight times more private vehicles in the United States than in all of Europe, the figure for Italy being one automobile for every 1,002 people, as compared with a ratio of 1/268 for the U.K.; 1/402 for France;

and 1/684 for Germany.[35] By 1928, one out of four U.S. citizens possessed an automobile, the figures for Europe being: Italy - 1/300; Great Britain - 1/40; France - 1/44; Germany - 1/68.[36]

As regarded public transport, Pietro Lanino in his study of competition in the transport sector concluded that only about 10% of public bus services could be considered in competition with the railroads, and in general, the lack of a competitive push from alternative means resulted in Italy possessing a particularly scarce and inefficient rail network, both in relation to land mass and population.[37]

Only from 1929 did the general decline in traffic, investment and marginally increased competition from automobiles have any effect on the railway system, and even here these factors did not stimulate technical change. Pressure to reduce costs was again felt largely only at the local level - operating costs in the state sector having been reduced by exclusive concentration on personnel cuts - and a number of light passenger trains were put into circulation, driven by steam locomotives.[38]

In the communications sector as well the state entirely relinquished investment responsibility under the fascists, with the predictable consequences for the development of a socially useful and wide-ranging system of communications for the peninsula as a whole. By March 1925 an underwater telegraph cable running from Anzio through Malaga to Horta, where it connected with the Western Union line to New York, as well as a line from Rio de Janeiro to Buenos Aires, had already been constructed and paid for by Italian emigrant businessmen, while there was still no efficient telephone system connecting up urban centers within the country itself.[39] When the investment decline and economic downturn began in 1925, which would continue on through to the mid-1930s, the only underground telephone cable network in Italy connected the cities of Turin-Milan-Genova through San Giuliano, which was the fruit of patent agreements between Pirelli, the dominant producer of cable, and Western Electric.[40]

As was the case with the electrification of the rail system, in the communications sector only management of very long distance telephone lines was retained by the state, and responsibility for urban and short distance inter-urban networks was passed to private industry in 1925.[41] In effect, and operating through the holding company Societa' Industrie Elettrotelefoniche (S.I.E.T.) this move put more than 40% of the entire industry into the hands of the SIP group of industries (Societa' Idroelettrica Piemonte), which also controlled 20% of the electrical power industry in the peninsula.[42] This manoeuvre was largely the work of the group's managing director, the engineer Giangiacomo Ponti, who also "was the first in Italy to bring the problem of a rational subdivision and coordination of labour into the Turin Industrial League, applying the personal experience acquired in the study of American industry."[43]

Passing a large part of communications services from public to private management had, however, been a long term demand of the engineering community, and the subsequent head of the Italian Standardization Institute Enrico Marchesi had made the point clear in late 1919, in a speech to his collegues on the problem of communications:

> There will never be a state in which (economic) measures, however simple, can be taken with the vigour and rapidity necessary to render them effective...some of you will have heard the question: but in the end, are you yourselves (engineers not the state? No, distinguished collegues, we are not the state...Engineers do not represent the state, in whose trap, however, we find ourselves caught...the major defect - perhaps irresolvable - of state management is that this ponderous, elusive and irresponsible entity becomes rigid in its organization which is then imposed on its functionaries without the possibility of protest.
>
> In private industry there is the manager in charge of the firm, who can organize it in the manner that he feels is most advantageous to the company. In the state this is not the case. The state covers its employees with a cloak of iron, often ornamented with brilliant decorations, then declares: "Get a move on! Work faster!"[44]

Under fascist authority therefore, in the organization of transport and communications a system was being designed in which local services

essential to the smooth running of business was passed to private operators, while the services retained by the state stagnated on a technical level through lack of investment funds, forcing recourse to a purely authoritarian and administrative conception of efficiency, and the traditional expedient of political underwriting of private industry.

In the long term, the tensions resulting from this lack of coordination and technical integration contributed to pushing the efficiency discourse into the arms of social and political reformers, compensating, through the imposition of authoritarian and hierarchical models of social organization, for the absent technological pre-conditions which the models assumed.

In the short term, this phenomenon was encouraged by the new competitive pressures and instability created by the institutionalization of science-based technical change, pressures captured in the phrase of the electrical engineer Marco Semenza that, "all peoples, in order to survive and not be isolated, must follow the same rhythm of life as all the others."[45] Entering the international marketplace as an equal, and arriving at the same necessary "rhythm" as all other producers, presupposed, however, the standardization of the means of production which the dominant "rhythm" dictated. The progress, or lack of progress, of this movement in Italy will be examined next.

The Standardization Movement

The standardization of production was a problem intensified by the exigencies of the war effort, and which demanded immediate attention. In Italy, the lack of industrial standardization in private industry was mirrored in the administrative fragmentation of the armed forces, and had important consequences for the prosecution of the war. The Navy, for example, used different designs for weapons that were functionally identical to those employed by the army. Even a different type of rifle was used by the two forces, as well as different artillery and caliber of bullet. [1] In the case of the armed forces, technical standardization had to be conceiv and implemented in parallel with the administrative fusion of the various branches of the military. [2]

Resolving the problem of standardization naturally formed an important part of reform work by the technical intelligentsia, and Ingegneria Italiana commenting in 1919 on the newly formed Engineering Standards committee in the United States, complained that

> in Italy, unfortunately, we are still a long way from a similar possibility. No institute exists in Italy with the power and authority of the Bureau of Standards...This is an important lacuna in our scientific and technical organization...[3]

It was evident that formulating the standards for industrial production had to be carried out in strictest collaboration and in conformity with the interests of the dominant industrial firms who would be producing with the standard measurements determined. For the engineers who would be responsibl for performing the technical work required in the determination of standard sizes and models, the primacy of economic criteria was not open to discussio Commenting on an International Standardization Congress in July 1923 on the initiative of the Bureau de Normes of the Association of Swiss Mechanics, L'industria observed:

> It is opportune to point out how every day, in the various industrialized countries, the function and economic importance of standardization is given increasing recognition, both in the field of production quality and technical standards, and in the area of simplification and limitation of types. This important principle of collective organization called standardization - in order to be really useful and not simply aiming to realize some theoretical ideal - must be guided by practical considerations, and in strict relation to the requirements of industry. [4]

Writing in the same journal three years earlier, the engineer Ettore Cardani had emphasized the same pressing need. [5] It was not enough, Cardani reminded his readers, to establish the units and models for industrial production. It was also necessary to construct the measuring instruments and calibers for practical application using practical tollerances. Such factors were clearly commercial, and consideration of them obviously implied a close collaboration with industrial employers: [6] "It must be recognized that a high level of output at low cost...is directly related as both cause and effect... with the firm resolution of the problem of standardization." [7] The problem, Cardani emphasized, was particularly grave in the post war economic world and demanded immediate attention. By contrast with Italy, Germany, the United States, England and France had already made considerable progress in the "disciplining of production". If Italy lagged in the formulation and imposition of industrial standards, not only would Italian products be uncompetitive in international markets, but also Italian technology and industrial products would not be compatible with foreign capital equipment. [8] Protectionism was therefore no longer an acceptable economic strategy - low cost production techniques had to be pursued, a necessary precept of which was a standardized and simplified system of industrial production. [9]

A more extensive discussion of the issue - no doubt based in large part on his war time experience at the Armaments ministry - was offered by the electrical engineer Ugo Bordoni within months of the war's end. [10] Bordoni's 1919 article for L'elettrotecnica (nominally concerning reform of technical education, but which is in fact a much broader contribution to the engineer-

ing literature of industrial reform, with specific reference to the question of standardization, was a response to a polemical intervention of a professor Nozari which had appeared in the 15 January issue of the same journal. Bordoni indicated the point of Nozari's argument to which he took exception: "It seems to me doubtful that the goal (of rationalized production) can be achieved by the means advocated by Professor Nozari, which consist essentially in the 'mobilization' - to adopt a word presently in fashion - of small workshops..." The major theme of Bordoni's discourse instead was the need to involve industrialists in the movement for economic reform, through industrial agreements on production standards to meet heightened foreign competition. The traditional Italian concern with variety and diversity in industry was denounced, and Bordoni urged the diffusion of a new mentality in the world of production which emphasized economic variables.[11]

Bordoni pursued his discussion by admitting that any small engineering laboratory was capable of building most of the equipment to used in the education system for experimental work. "However," he continued, "one is dealing not only with 'machine construction' understood generically; rather, we must concentrate on 'construction' in an industrial manner - that is, to build not just well but also <u>at limited prices and rapidly</u>. To realize this goal, the small engineering laboratories, and especially those annexed to the medium and high schools, do not seem appropriate to the task at hand." Such small scale operations were acceptable as long as the aim was limited to "improvising" equipment. It was a different problem, however, when "one is talking about building machines <u>to sell on a competitive market</u> against products of foreign industry."[13]

The Italian system of producing a wide variety of products and plant sometimes responded to specific requirements of the economy, but most of these differences were

> purely arbitrary, and depend on the producers, mostly foreign, who put them on the market...We must ask ourselves if all this really must be accepted as inevitable, or if it would be possible, on the

> example of some large scale industries, to proceed to a gradual and rational "standardization" - or, more italianized, "unification" - of the various types...The fundamental concept of unification should be to manufacture only those articles or equipment that perform different functions and serve different ends. And the standard types would be decided upon the views of those in the schools and laboratories.[14]

An additional and necessary innovation would be that in deciding on the particulars of a given design project, the active presence of the works engineer would be crucial to give the overall scheme a practical framework.

In his analysis, Bordoni stressed the debilitating legacy of foreign investment in Italy. The multitude of different screws, bolts, dies, plugs and so on used in machine construction, and the various spinning technologie in operation in Italian industry (Whitworth, Lowenherz, Thury, Martin, Carte and Latard) had no technical rationale since the systems were virtually identical. They simply represented a strategy of foreign investment which was designed to make it difficult for Italian purchasers of these technologi to repair or reproduce them on their own.[15] In the post war world, Bordoni argued, such a problem need no longer exist, because the underlying factor of dependence had been corrected by the years of isolation during the conflict.

Although limited, there was also a role for the state to play in this conception of the nascent industrial order. In Bordoni's vision, political intervention had to primarily take the form of simple legislative action to prevent inefficient projects in the engineering industries from ever being realized. The state would function as a sort of technological arbiter to ensure that only those projects which conformed to the principles of efficient and economical production - through permitting financing only of manufacturing processes that followed standard specifications - were undertaken.[16]

Bordoni expected that the standardization program would raise many objections, since it ran up against many private interests, "for the most

part foreign." [17] In discussing industrial reform, however, he felt it necessary to concentrate on the question of standardization, to emphasize a complex problem that "in the end concerns a class of person who...until now has intervened too little: the industrialists...why do they not tell us how, in their judgement, the desired form of industry could be given life?" [18]

The first institutional initiative in the process of industrial standardization in Italy took place in Milan in January 1921, when the Comitato Generale per l'unificazione nell'industria meccanica (UNIM) was established. As was the case in most industrialized countries, the initiative was spearheaded by the mechanical engineering sector, and this early organization formed part of the already existing employers' organization, the Associazione nazionale fra gli industriali meccanici ed affini (ANIMA). [19] The formation of UNIM made Italy the ninth industrial country to establish such an organization (the first had been set up in the U.K. in 1901), and the institute was made up of representatives of ANIMA, the comitato nazionale scientifico-tecnico, the National Association of Italian Engineers, the Italian Association of Electrical Engineers, and the national employers' group, the Confederazione Generale dell'Industria Italiana. [20] The first president of the Institute was the engineer Enrico Marchesi, who held the position until his death in 1934. The job of director was held by the mechanical engineer Italo Locatelli, who was replaced by Renzo Curti in 1941. [21]

The aims of the organization as initially formulated were to determine standard parts and instruments used primarily in the mechanical engineering sector. The highest technical organ of UNIM was designated the Commissione Centrale Tecnica (CCT), which was put under the charge of the engineer Luigi Greppi, who held the job until 1948 when he was appointed overall president of the standardization institute. [22]

The main responsibility of the CCT was in examining and coordinating

proposals coming from the various Technical Committees(CT) formed within the CCT, the initial five of which were: screw threads and bolts; pipes, tubes and taps; machine tools; spark plugs; and pasta machines. A section for determination of naval construction standards soon followed. [23]

The starting budget of UNIM was a mere 4,000 lire, which by 1926 had increased to 300,000 lire, in large part "thanks to the interest shown by professor Giuseppe Belluzzo." [24]

Apart from carrying out investigations of Italian enterprises in the determination of standards, the various commissions also took care to be informed about "similar work abroad, with which the Italian committee maintains active collaboration through reciprocal exchanges and visits." [25] Indeed, the process of industrial standardization in Italy, as elsewhere, was conceived and developed, though perhaps more ponderously than elsewhere, in the context of collaborative efforts taking place internationally. The Italian organizations concerned were the Comitato Elettrotecnico Italiano, of which Guido Semenza and Ulisse del Buono were the main figures; and UNIM, whose representatives participated in the work of the International Standardization Association (ISA). Having been promoted by the British Engineering Standards Association, the English then withdrew from membership of ISA, as did Canada and Australia. The United States was also absent from membership in the international organization (notwithstanding the fact that ISA was initially founded in New York in 1926), and in 1928 ISA headquarters were set up in Prague. The transfer of the head offices coincided with the holding of the first International Scientific Management Conference in Checkoslovakia under the initiative of Tomas Masaryk. Italy was represented at ISA from its inception, participating in the work of several of the commissions formed, including those for automobiles, iron materials, naval construction, technical drawings, and steam boiler pressures. The absence of the English speaking industrial world, no doubt in part due to disputes over the metric system, was however a decisive obstacle in the way of

making ISA an effective and credible presence in the "international" universe of technology.

Before breaking up in 1943, with the United States and Great Britain forming the United Nations Standards Coordinating Committee, ISA was headed by the Italian engineer and senator Giovanni Tofani, who had resigned as president of the Italian organization UNI the same year. [26]

With the pride that reflected how much of a manufacturing neophyte Italian industry was in the inter-war period, the journal Elettrotecnica gave voice to some of the benefits to be garnered from international collaboration on detailed issues of technological complementarity:

> Few things are necessarily so international as technology, and we believe that the greatest service that we (engineers) can offer our industrialists is to keep them well informed...Thus, with the deepest satisfaction we can inform our readers about a brilliant affirmation of Italian industry in the United States of America. The New York Edison Company, Edison Electric Illuminating Company of Boston, and the Commonwealth Edison Company of Chicago have recently entrusted important contracts for high tension cable to the Pirelli firm of Milan. [27]

Call it "a tangible recognition of the superiority of our industry," the engineer braved. [28]

Notwithstanding such "superiority", the head of the Italian Electrical Engineering Association, Barbagelata, indicated in January of the same year that the process of standardizing measuring instruments in electrical technology had not progressed in Italy since before the war. [29] If technology existed merely for its own sake, Barbagelata observed, "approxima correctness" would be acceptable, but when the function of such devices - simple wattmeters and counters - had a direct economic impact, exactitude was essential. [30] In the case of electrical energy, sales volume was increasing so drammatically that standard devices for the measurement of consumption could not be neglected by either buyer or seller: "if very often technical progress has had profound economic consequences, it is equally true that often only economic necessity renders further technical

progress possible." [31] In the standardization of electrical equipment in Italy, however, three years later in 1927 there was "still everything to be done." [32] Clearly one of the major obstacles in standardizing electrical construction material was that it depended on a prior standardization of tensions, an unsolved difficulty throughout the inter-war period which was discussed earlier in the thesis.

The same complaint was launched for this sector as had been articulated by Belluzzo for the engineering industries during the war: in the electric equipment sector, unlike the prevailing situation in the United States and Germany, producers "have let themselves be attracted by the mania to want to do everything, from small to large scale electro-mechanical construction. And it was precisely because of minimal specialization and collaboration between producers, to create industrial alliances on the principal of vertical integration, that Italy had been left open to penetration by foreig investment. Domenico Civita observed that electrical equipment manufacturer were always bemoaning the preference of energy producers and distributors for doing business with foreign companies, but "they do not reflect that it is their own fault, because they refuse to follow the example provided (by foreign manufacturers)." [34]

The first step, it was suggested, would be to standardize "secondary tensions". Investment in this direction would rapidly pay off in the economies of scale resulting from acquiring all electrical construction material for a single generating tension, the American example of basing the system on 110 volts being cited as the procedure to follow. Again, this problem was dealt with earlier in the thesis.

In the meantime, isolators, street lamps, reflectors, valves, lamp fittings and so on had yet to be standardized in Italy. Meters and guages for measuring voltage and consumption were virtually all purchases from abroad, as were 50% of all lamps used in Italy imported, since domestically produced, non-standardized types were more expensive. [35] Moreover, there

was no product diversification in the electrical equipment sector in Italy, which would have served to increase domestic consumption of electrical energy(i.e. household appliances, such as refidgerators, electrical stoves, irons, vacuum cleaners, water heaters, etc., as had already got well underway in the United States by the mid and late 1920s).

The conclusion of the engineer Civita in December 1927 was therefore that

> it is necessary to organize...the point of departure should be standardization or unification. If it were realized for a large number of articles, the subdivision of labour between factories, production agreements between producers to create concentrations or consortia would follow almost automatically, just as scientific management according to the principles of Taylor or Fayol would follow almost automatically in the individual shops. [36]

In commenting on the widespread enthusiasm in the contemporary engineering reform literature for the U.S. Bureau of Standards, a more cautious and obscurantist voice came from the same sector as the more crusading Domenico Civita. In a meeting of the Italian Electrical Engineering Association in Brescia in September 1926, the electrical engineer L. Lombardi argued that a similarly streamlined and efficient organization as the Bureau of Standards was neither realistic nor practical in Italy of the period, given the state of industrial organization, and the fact that many of the functions of the American institution were already performed within individual offices of the Italian state - the Istituto Superiore Postale e Telegrafico, the Istituto Sperimentale delle Ferrovie dello Stato, the Istituto di Elettrotecnica e Radiotelegrafica of the army and navy, and so on. [37] In anticipation of the formation of a comparable institute, and the development of the economic structures which presupposed it, Lombardi suggested that the state could actively participate in the standardization movement by supporting the proposal of the recently constituted National Commission of Pure and Applied Physics in sponsoring a National Research Laboratory, which would have the responsibility of determining the principle units of measure for electrical

technology.[38] This did not mean, however, that the ultimate aim should not be an organization similar to the Bureau of Standards, and its structure and function should serve as an ideal model to be studied by reformers in Italy.[39]

In the mechanical engineering sector, only sixteen standardization tables had been published between 1922 and 1925, which increased to only 64 a year later, corresponding to the first year of Belluzzo's incumbency at the Economics ministry. These specifications included the important step of accepting Whitworth screw threads as the standard measures for Italian industry.[40]

Until 1928 research work at UNIM had been carried out under the almost exclusive financial sponsorship of the employers' organization, the National Association of Engineering Industries (ANIMA). For the observer writing in L'industria in 1923, this

> demonstrated that Italian industrialists do not want to simply ensure their survival by government intervention through tariff protection. Rather, they are lookiong to achieve rational organization of labour through technical progress, and through collective agreements to improve production techniques and reduce costs.[41]

Indeed, in 1928 UNIM underwent reorganization, which removed it from forming part of ANIMA, and it was made an organ of the national industrial employers' organization, Confindustria, at which time the name was changed to L'Ente Nazionale per L'Unificazione (UNI). This change corresponded with an expansion of the institute's initiatives beyond the concerns of the engineering sector, an increasing withdrawal of the state's presence in the affairs of the organization, and a much greater direct presence of Confindustria.[42]

This shift was reflected in the sources of funding for the organization. Between 1926 and 1929, Confindustria's contribution rose from 30.5% to 78% for the standardization institute, while the financial support coming from government ministries and the Comitato di Mobilitazione Civile[43] dropped from 62.6% in 1926 to 5.7% in 1929.[44]

The conspicuous absence of the state was infact viewed as a major obstacle in the development of an effective standardization organization on the level of the U.S. Bureau of Standards. [45] The situation was to have bee turned around in January 1931, when the headquarters of UNI were moved to the offices of the Fascist General onfederation of Industry in Rome, and fascist minister of Corporations Giuseppe Bottai was made honorary president of the standardization body. [46] In his opening address at the establishment of the new offices, the engineer and president of UNI,Enrico Marchesi, stressed that "it was important for the state to intervene to help realize the proposals of the organization, whose functions are part of a larger reform effort to increase production, which the government is pursuing, principally through the establishment of the Corporations." [47]

As part of broadened operations of UNI, not only standard types, primarily for the mechanical engineering industries, were to be dealt with but norms and specifications for all of Italian industry were to be determin under the authority of UNI. The economic importance of such an initiative was clear, as Marchesi pointed out: "Standardization is essentially a form of collective organization intended to reach a better and more economical output." [48] Indeed, from the mid 1920s, all major decision making at UNI would be the responsibility of Confindustria appointees, the existence of UNI itself largely being due to the efforts of Arturo Benni, head of the employers' federation, and to scientific management enthusiast Gino Olivetti. [49] In the important section which regarded standardization of parts for the automobile industry, two FIAT engineers, Cappa and Piselli, were put in charge and, as Luigi Greppi (head of the Comissione Centrale Tecnica of UNI from 1928, and president of UNI from 1946) informed the participants at the opening of the new offices of UNI in 1931, the technical office of the standardization institute in Turin was directly financed by the National Association of Automobile Manufacturers and Associates (ANFIA - Associazione Nazionale Fabbricanti Automobili ed Affini).

Despite the claim of Marchesi, however, that the new statutes of UNI were informed by the criteria of industrial collaboration corresponding to the "enlightened directives which inspired the formation of the (fascist) National Council of Corporations",[50] the political, economic and institutional worlds of Italian society in fact met at very few points indeed. The industrial development, coordination and specialization that was the prerequisite of such corporatist harmony never took place during fascism, and individual industries and monopoly producers continued to pursue an industrial strategy based on the characteristic fragmented capitalism of industrial "late-comers" of labour suppression and monopoly privileges.

Bottai, nonetheless, pursued his corporatist illusions, claiming at the January 1931 opening of the new offices of the standardization institute that "my presence here (testifies) to the interest with which the fascist government views your work."[51] Gino Olivetti's critique was cited on the diffidence, "sometimes even ironic" attitude of some economic writers in Italy in dealing with the work to rationally order the Italian industrial economy, work "of which the standardization movement is nothing less than one of the most significant aspects."[52] And in this work, Bottai mythologized, the fascist state would make and was making a decisive contribution: "If there is a state in which these measures should find...their natural road to development, it is the Italian state, the fascist state, the corporatist state, the state which has rationally organized and disciplined economic groups."[53]

In the end, as the reports of the same inauguration meeting revealed, lack of personnel and funds had reduced UNI to being mainly an administrative rather than technical organization, confining its activites to making up reports, distributing propaganda on the importance of standardization, and corresponding with individual firms and offices of government ministries.[54] Although, as the engineer Carlo Rossi pointed out, commercial transactions in intermediate industrial inputs could be greatly speeded up and streamline

if parts could be ordered by making simple reference to standard codes - which "has perhaps more of a commercial than technical ring to it" [55] - as late as 1962 there were still no courses on offer in the technical schools in Italy on the methods and economies of industrial standardization.[56]

It would seem, therefore, that little progress had been made since 1920 in the reform struggle to bring science, industry and culture together, to form a base on which the new social order could be molded. The debate on standardization, although it constituted an essential and fundamental format for working out a reformist discourse for Italian industry, nonetheless formed only a part of a much broader critique by the engineering community on the overall organization of production in Italy. To complete the picture of the contemporry perception of industrial weakness, and the articulation of reforms necessary to improve the fragile economic structure, it is necessary to give an account of the post war engineering critique of the industrial order in which these protagonists of the conservative revolution to come were compelled to work.

"Americanismo" and the Critique of Industrial Organization

"We entered peace time unprepared, as we had entered the war," Pietro Lanino wrote in the reformist journal of his own creation, Ingegneria Italiana in 1920. [1] Two years earlier, in his 1918 report to the government Comissione del Dopoguerra on industrial organization in Italy, Lanino had cited some statistics which were intended to illustrate the technical and organizational problems that underlay inefficiency and high production costs in Italian industry. [2] Essential to the problem, Lanino observed, was the unspecialized character and small scale production methods of the vast number of industrial producers. Even near the war's end, 87% of Italian firms still employed less than ten workers. Also, the horsepower/worker ratio in industry was very low, and made production increases practically impossible. In 1911 the engineering industries were producing at less than one h.p./worker, the textile sector even less. [3] The machine, Lanino pointed out, was at least 90% more productive than a human being, and if production was to increase in the future there was no alternative but to enact a massive campaign to transform industrial organization, beginning with a greatly increased capitalization of production processes: "man must be subordinated to the machine...the need...for labour to adapt to the full, rapid and intensive exploitation of machinery is becoming increasingly important for efficient production economies." [4] Social and economic problems in Italy, it was argued, were not a question of the distribution of benefits and resources between capital and labour. Rather, the answer to such problems lay in solving the economic fact of high production costs which applied permanent downward pressure on demand. [5]

In an extensive analysis of the structural weaknesses of Italian industry in 1919, the engineer Franco Malerba had emphasized similar points. [6] First

the basic characteristics of mechanical production in Italy were outlined:
1) very few large scale enterprises in the major urban centers, producing a variety of products, contrasting with a much greater number of small and medium sized firms, also manufacturing a wide variety of commodities, though at much higher cost;
2) in some of the larger companies mass production techniques had been implemented, but the majority of firms operated on a batch production system
3) all firms, both large and small and with very few exceptions, produced internally almost everything needed for production; there was almost no vertical specialization, and very few finished parts had to be acquired from outside the enterprise that would have been ready for simple assembly;
4) for reasons of competition or "love of variety", manufacturers insisted on differentiating their products, even if machines of the same power and functi were produced, and that would eventually operate in identical conditions. In many cases, Malerba argued, the differences were only aesthetic;
5) scientific management was almost unknown in the engineering sector;
6) the industry was characterized by permanent conflict between capital and labour.

In Malerba's assessment of the situation, the consequences of these features of the engineering industry were low productivity (both of workers and machines); waste of raw materials due to "irrational" and unregulated distribution of inputs; high production costs and low wages; a general discontent among the working class; and because of the lack of integration and collaboration between industrial employers to effect a greater specialization, there was always the danger of "doppioni" (redundant producers) and neglect of product diversification.[7]

All the basic problems of the Italian engineering industries had been brought to light by the exigencies of war production. In the working of mechanical parts in machine construction, the Americans had taught the economical practice of working to precision only the surface of the pieces

to be assembled, leaving rough the components which did not require precision calibration or sanding. [8] Such a practice was virtually non-existent in Italian workshops before the war, and not done at all in government arsenals. Production specifications were therefore far from economical, reflected, for example, in the manufacture of accessory parts for the simple mechanism of canon brakes. New processes for molding and fusion of metals were not taken into account, and these pieces were made by a long process of working from a block of steel, wasting a great deal of material. [9]

In particular, too much time, money and labour was wasted during the war because of the absence of a vertically specialized industrial structure, based on collaboration and standardization in the engineering sector. Individual producers would prepare each of the technical designs, the models to be worked and the suitable production equipment, while agreements between industries on standard types would have saved enormously on both costs and time. [10]

The solutions proposed in Franco Malerba's industrial reform project involved three general conditions:

1) simplification of products (i.e. reduce the variety of articles manufactured;

2) standardization of the products selected to manufacture.

3) elaborate vertical specialization in industrial organization.

Fulfilling these conditions, Malerba stressed, would give Italian industry the only possibility of competing in the harsh economics of the post war world. [11]

Malerba became somewhat more ambitious and utopian when postulating the ideal conditions for the manufacture of any industrial commodity:

1) a single factory to produce all articles of the same type

2) if the particular article in question could be disassembled into a number of pieces, these pieces should be produced in a single factory

3) diversity in product design should be minimized: "designers will have to sacrifice their artistic talent";

4) for certain very complex products that involved many interlocking and diverse parts (ships, locomotives), firms should be established only for the assembly of the component pieces;

5) scientific management was essential in every industrial workplace, "possibly with worker profit sharing or bonus schemes".

How such a technological paradise was to be realized - perhaps one of the most bare-faced recipes for monopoly conceived during the period - was not indicated, but the economic advantages of such a specialized and standardized industrial system were clear. A beginning could be made, Malerba suggested, by standardizing specifications for those articles which were common to any mechanical technology: screws, nails, dies, bolts, levers, wheels, pins, etc. In many Italian factories of the time, all these parts were produced internally according to specifications determined by the individual customer or firm, which resulted in a multitude of differing technologies and labour processes. In the case of machinery, therefore, the basic principle of interchangeability was violated, as was the possibility eliminated of measuring and fixing standard times for the labour process for the industry as a whole. [12]

In any case, the engineer concluded, the entire question of implementin such reforms in the competitive environment of the post war world had become merely academic: with the "one best way" of industrial production having been fixed by the American model, the choice was either to renounce selling industrial commodities entirely and accept the market being flooded with m more cheaply produced foreign products, or follow the rest of the industrial ized world in adopting the dominant model, and at the same time use science to innovate new products and processes to break the bond of foreign control over Italian industry. [13]

Even armaments manufacturing had been under foreign control at the outbreak of the war, either through affiliate companies (for example, Armstrong of Pozzuoli), or through patent holdings (Vickers, Schneider, Krupps, Armstrong). Because of low productivity levels, however, often even finished military products and components for canons, pistols and machine guns had to be imported.[14]

Indeed, it was the institutional and economic restructuring of the war and immediate post-war years that gave the voice of conservative reformism a special urgency. At the heart of the new movement lay an aglomeration of economic and technical considerations that were collected under the generic label of "americanismo". Later to be used and abused, misunderstood and misappropriated on various levels of culture and society, such a powerfully suggestive abstract noun was originally transferred to Italy (and the rest of Europe) as a body of technical and administrative thinking that referred specifically to the organization of production in advanced capitalism. It followed that those who were in closest contact with the structural changes underway, and who in part would come to see themselves and the unrecognized protagonists of the prospects and prosperity to be created by such change - production technicians and engineers - would be the first to concern themselves with the meaning of "americanismo".

To identify it, in its essentials, was relatively straightforward:

> the fundamental characteristic that forms one of the cardinal points of originality and high output of American technology is this: all questions are studied with scientific criteria, but always interms of their practical application...in the place of Germanism there is now Americanism. It is a fact.[15]

However, new methods of standardized mass production, and the concept itself of the "science" of industrial organization, was both a blessing and a curse. If these innovations seemed to allow for previously undreamt of productivity levels and a mobilization of factors of production never before considered, they also served to shatter old concepts of the international division of labour, and greatly intensified capitalist competition between

and within national economies. Industrialized science, "americanismo", had not only revealed the "one best way" for producing cheap goods and services, it was also based on the physical transformation of natural resources through the systematic application of applied science. In theory, this meant that areas such as Italy, scarcely endowed with the raw materials required to play an equal role in the first industrial revolution, needed no longer tollerate a subordinate position in the international division of labour. The function of raw materials themselves could be redefined by the applicatic of new scientific technologies and systems of production organization.

Implementing industrial best practice meant, however, importing it, which in turn implied international cooperation in the transfer of methods and ideas. Even before the war's end, some preliminary steps had been taken in this regard, with Italian representatives participating in inter-allied meetings to formulate a development program for European industry, at the expense of an isolated Germany. One example in the field of scientific and industrial cooperation were meetings held at the Royal Society in London in October 1918, and in Paris one month later, to facilitate agreement on international patent laws, organize exchanges of scientific and industrial "attachés" between allied countries, and unify the various national research councils operating in individual countries into a cooperatively organized International Council of Scientific Research.[16] Based on an initiative of the British scientist George Hale, the organizatior would be founded on open recognition of the fact that developments in science and technology during the final years of the nineteenth century had forced a relationship of stricter cooperation between industrialized areas.[17] Following agreements with the Italian minister of transport Villa (on whose ministry the Office of Inventions and Research depended) the Associazione Italiana per L'Intesa Intellettuale fra i paesi alleati e amici was formed, and offices established at the University of Rome.[18] Vito Volterra of Rome University was designated president of the Association.

the head of the Bank of Italy Bonaldo Stringher was appointed chief administrator, and among the Association's administrative secretaries was the corporatist economist and collaborator of fascist finance minister Alberto De Stefani, Luigi Amoroso.

At the Paris meeting of scientific and industrial reformers in November 1918, the subsequent president of Milan Polytechnic Fantoli read a report on International Technical Cooperation, in which the suggestion was made to establish obbligatory international unions between similar nationally based technical associations. An international institute of documentation and research was required in Fantoli's view, since the present organization of nationally based technical research involved too much duplication and wasted time and effort working on what were essentially identical problems.[19]

In the analysis referred to earlier undertaken for the government Comissione del Dopoguerra, the Italian transport engineer Pietro Lanino neatly characterized a contrary and complementary feature of the post-war industrial regime to that of the reformers gathered in London and Paris, explaining why it was so important for reform efforts in Italy to pay particular attention to the implications of the changes underway. Under the heading "Coordination of Industries", Lanino argued that one of the highly significant characteristics of the post-was system of manufactures was the tendency of each nation to close off the production cycle of its complementary industries within its own political borders, reducing imports of essential raw materials, and encouraging the growth of exports. A new form of economic struggle had begun, a struggle to discover ways of synthesizing and substituting essential raw materials that would serve as alternatives to expensive imports. Perhaps even more important than such applied scientific research, however, was the question of reorganization of the industrial structure itself, along the functional lines determined by th complementarity of science-based production.[20] Science was a necessary

but not sufficient prerequisite of industrial prosperity and competitive strength; "organization" was equally, if not more important a factor.

In one of the few contemporary analyses that attempted to view Italian political and social development in the 1920s in the broad light of industrial changes underway, Gualberto Gualerni described a key feature of the post-war stage of Italian industrial capitalism in the following way:

> As well as the expansion of capacity, mass production also meant the prevalence of fixed over circulating capital, and the need for investors to have guaranteed sources of supply and outlets for their products..These requirements gave rise to a progressive passage from technical to financial concentration; from private agreements or guarantees by the public authorities to regulate competition to new market forms; from sporadic episodes to increas ingly active intervention by the state...it was becoming urgent, besides just rationalizing production, to avoid wasted time in the movement of inputs from one firm to another in the manufacturi process, realize economies of scale, strike accords to confront international competition, and cancel the negative effects of domestic competition. [21]

Here was the real lesson of post-war "americanismo", and the practical realization, through organizational reform, of the technical concept of efficiency. "Each industry", Lanino explained, "in a rationally organized, modern industrial regime cannot exist only in and for itself. One industry, with its sub-products rationally isolated, can give life to a new industry, sometimes to a completely new group of industries. It can correct completely or in part our natural deficiency of raw materials." [22]

In a speech made to a national congress of industrialists in Rome in December 1923, fascist minister Giuseppe Belluzzo emphasized the cooperative imperative demanded by the new production methods, and reminded the representatives of Confindustria present of the need to organize themselves with more reference to technological categories. Italian industry could survive, Belluzzo argued, only by conquering markets presently dominated by foreign companies, which required the production of new, better and cheaper products, which raised "the problem of using the tools offered by science, which show us the way to arrive at this goal." [23]

With respect to the technical and organizational questions at hand, the issue of capital/labour relations would gradually become less important as workers came to realize the need to collaborate with employers. Instead, "the questions that (Confindustria) will have to deal with in the future will be technical, and such problems can only be resolved by technicians themselves." [24] In particular, the problem of exports would have to be examined by technical personnel, "analogously to what happens in industrial organizations abroad...without engineers, industry does not prosper in a regime of competition," and if there is any growth at all it is "fictitious", concealed "in the unhealthy shadow of strong tariff protection." The success of a reform program informed by science, however, depended on agreement and cooperation between various groups of industries,"that until now has not been realized, because of the usual rivalries between industrialists." [25] Equal participation in the manoeuvrings of international economic power left no room for choice:

> while abroad the process of industrial concentration is moving ahead in leaps and bounds - the necessary prelude to the formation of international cartels - Italian producers should bear in mind that to be able to adhere with dignity to these cartels they must register an output worthy of the attention of foreign producers. And such strength can only be achieved today by the coordination and concentration of more efficiently organized complementary industries. [26]

Writing in the fascist journal Gerarchia in 1926, Virginio Gayda argued the same equivalence between science, efficiency and the large scale, integrated corporate organization of production: "strength and progress lie in large, coordinated units: the victory goes to science." [27]

Competition, therefore, the concept at the very heart of industrial capitalism, took on a radical new meaning with the elimination of all but the "one best way" of manufacturing industrial commodities. [28] The imposing and embarrassing fear of continued economic subordination and dependence, achieved in the past primarily through technical mechanisms and liberation from which in the future could only be realized with the same mechanisms,

also animated a curious intervention by the professor of electrical engineering, G. Revessi in 1919.[29] In all fields of Italian economic activity, Revessi began - banks, offices and factories - "the German has never been lacking". High finance and culture had been dominated by German interests, the dumping of industrial products in Italy was common practice, and patents had been used to "limit or choke our industry".[30] The hegemony of the "teuton" even extended to the "German monopoly of Neopolitan songs."[31] In Revessi's view, German investment in Italy "aimed not only at the economic expansion of the country, but was the first step in stabilizing German political control over the world."[32] Despite these ambitions, however, German investment, however odious, had been necessary, and Italy would never have been able to develop an indigenous industrial capacity on its own.

The important question was how German industry managed to become so powerful in the short space of a few decades, and thus be in a position to impose subordination and dependence on other areas. For the answer Revessi referred to the ideas of David Lubin, the American responsible for the creation of the International Agricultural Institute, and with whom Revessi was put into contact through his work as representative of the Associazione Elettrotecnica Italiana on an Italian-American committee to promote "collaboration" in technical matters between the two countries.

The key factors in German economic success, Revessi summarized, were applied science, technological dynamism, highly trained specialized personnel the absence of anti-trust legislation, and an autocratic state, which provided industrial subsidies, offered fiscal relief to industrial producers, and invested in external economies. Taken together, it had been the fact of the difference in productivity levels between German and foreign industry, realized through economies of scale and efficient industrial organization, which had permitted such low selling costs and ensured that their products and manufacturing systems would flood the Italian market.[33] The almost four year of war had allowed "latent energies" to emerge in Italy, but the

problem was now to confront the danger of the same relationship of dependence being repeated with the victors of an eminently economic war, particularly the United States. As a possible solution, Lubin began by pointing out that in the Mediterranean basin surrounding Italy there were hundreds of millions of people dispersed, an almost infinite source of potential labour and markets. There was no reason why goods produced for these areas by Italian artisanal methods could not be replaced by American goods manufactured by American methods, with Italy functioning as the industrial base for this new form of trade and commerce. Later, Lubin suggested, similar bases could be set up in Greece and Palestine. [34] It would first be necessary to begin by "americanizing the selected zone as an industrial base", to not only allow American products to flow in, "but develop and americanize industry in such a way that gradually the goods to be exported in the Mediterranean basin would increasingly be manufactured in Italy. This would require, to a very large degree, the capital, methods, and in general the collaboration of the Americans and...the British." [35]

In response to the criticism that such a program of expansion would involve creating a possible competitor to U.S. industry, Lubin showed in fact that the most powerful economic adversaries were also always each others best customers. "Americanized industry," therefore, "even admitting that it could become a dangerous competitor for the United States, would also certainly become an even better client for raw materials, machinery, manufactures and capital." [36] In any case, and regardless of whether the Italians cooperated in such an industrial strategy, Revessi observed, American goods would flood into European markets, so it would be rather more profitable to participate in the plan than wait for such outposts of American production to be established elsewhere in the Mediterranean. [37]

Revessi was careful to emphasize that the possibility of U.S. domination in Italy, through control over industrial production and financial resources, did not frighten him in the least. His views on the matter, he explained, were determined only by technical considerations, not financial interests,

and his approach to the project suggested by Lubin was entirely "without preconceptions". [38] Indeed, Lubin's ideas were "a natural corollary in the economic and industrial field to the project that President Wilson is carrying forward in the political arena." [39]

Ironically, it had been one specific policy decision by the United States - the tightening of immigration laws in 1921 - which, at least in part, forced such choices on reformers such as Revessi. As a contributor to the Rivista d'Italia e d'America pointed out in 1925, "the only great economic resource of Italy is its capacity to produce labour", and with the change in U.S. policy this export commodity, paid for by emigrant remittance had been effectively blocked, forcing Italian producers to consider exporting labour under another form - industrial products. [40]

It had thus become a matter of immediate political concern to deal with the issue summarily expressed by Alberto De Stefani in 1926: "There is a problem, a fundamental problem that dominates all others in considering the organization of our industrial economy, and the possibility of competing effectively abroad: the challenge of reducing costs of production." [41] In the view of textile industrialist Benigno Crespi, reform had to be concentrated on overcoming an excessively "liberal" mentality amongst industrial proprietors, which in the context of Italian reformist discourse referred to "the instinct to always want to appear more 'shrewd' (not more intelligent!) than competitors." [42] Here Crespi was referring to the well-worn critical saw in Italian reformism that there was too much "individualism" in Italian industrial industrial organization, and too little "cooperation", in the form of corporate cartels and a more oligopolistic industrial structure.

The debate on the appropriate industrial organization for Italy was not however, a unitary discourse. Here two rather more cautious voices will be considered, the first that of the economist Lello Gangemi writing in Bottai

journal Archivio di Studi Corporativi; the second, that represented in a major report submitted to the National Economic Council in 1926 by the engineer and textile industrialist Carlo Tarlarini.

Gangemi began by observing that the cartelization movement in European industry was given a decisive push by war-time industrial organization, and "brought attention to American methods and systems of organization." [43] The changes in the structure of business organization was a revolution no less important than the introduction of mechanization and factory production in the nineteenth century, however if the cartel movement were to continue completely unchecked, large industrial formations could pose a major threat to the autonomy of the state itself. Gangemi counselled caution for Italy, urging that the state not become a virtual slave of big business groupings as it appeared to be in the United States. [44] In any case, the structure of production organization was so radically different in Italy that any attempt at immediate and radical reorganization could only be counter-productive. Mass production methods in American industry, cheap raw materia a large domestic market for industrial commodities and, to some degree, access to colonial markets permitted permitted development of productive forces in the United States which, if a similar investment program were followed through in Italy, would result in machinery being idle ninety percent of the time. [45] Italian industry enjoyed none of the above mentione advantages, which made it particularly dependent on export markets, and thus dangerously sensitive to demand fluctuations abroad. [46] The dilemma facing the Italian economy was therefore far from amenable to simple solutions: having previously chosen the capital intensive model of development, without however being able to profit from cheaply available factor endowments, many Italian producers found themselves having to face the problem in the 1920s of investing in technologies and competing in markets which the resources and organization of the economy did not rationally permit.

Gangemi therefore argued that there was room in Italian industrial organization for all types and sizes of firms, both capital and labour intensive, and that a relative application of "rationalization" techniques was possible and correct for Italy. It was here that the corporatist organization of the state had a role to play - in bringing capital to the countryside, road construction, expansion of the communications network, land reclamation schemes, and so on.[47] In Italy there was no anti-trust legislation of any kind, but it was essential that the state intervene to encourage price agreements and avoid overproduction resulting from excessive investment in capital equipment: "The rationalization fever," Gangemi continued, "(encouraged by easy credit) has led to overproduction in a world where the contradiction between increasing production (the consequence of technical progress) and increasing protectionism impedes the rational utilization of plant, and therefore blocks the need to reduce costs and increase consumption."[48] In such an economic context therefore - and with Italian producers disadvantaged by expensive raw material imports, a weak capital market, protectionism abroad, almost no domestic market for consumer goods, no colonies and a disorganized system of foreign trade - both capital and labour intensive industries could co-exist, the latter serving as a buffer to avoid fluctuations in world demand.[49]

In his report to the fascist National Economic Council, Carlo Tarlarini emphasized similar points, addressing however, some very powerful figures in the world of Italian industry. Present at the meeting of the National Economic Council at which Tarlarini delivered his report - entitled "Towards a Scientific Organization of Labour and Commerce" - were General Alfredo Dallolio of the war-time armaments ministry, and in 1926 in charge of industrial planning for the military in peace time Italy; International Labour Office representative Giuseppe De Michelis; the industrialists Giorgio Falck, Gino Olivetti and Pirelli; and former Confindustria president Giovanni Silvestri.[50]

Tarlarini initiated his discussion by dismissing as unimportant the alleged differences between Taylor and Fayol in their conceptions of management. It was more important to point out, as Alessandro Giambitto was to do at the Rome scientific management conference in 1927, that "among the principal enemies of scientific management, the most obstinate, are certainly empiricism and skepticism." [51] The former was the greater problem, since it represented the obscurantism of foremen and shopfloor managers, who stood as the major obstacles to the rationalization of Italian industry at the shop floor level. [52] In general terms, that there was indeed a pressing need for some form of rationalization and organizational reform in the economy, beginning with scientific management and standardization in factories, was an indisputable fact of the increasingly integrated technological environment of the 1920s: "Today more than ever, scientific management is demanded in all fields of activity, and those who adopt it first and most efficiently are very much advantaged over peoples who employ these techniques later or only partially." [53] In addition, the requirements of post war reconstruction in a regime of competition "gave the question a political and public face, and from being a problem which concerned only the private sector, was transforme into a problem of the national interest." [54]

The "core" of the issue, however, as perceived by Carlo Tarlarini, lay in the relative appropriatness of the new organizational models and methods in specific economic and social environments: "The norms (of scientific management) do not constitute a course of fixed rules that can be rapidly and wholly applied in every case." [55] Apart from citing the structural weaknesses of Italian industrial organization - virtually identical to those emphasized in the work of Lello Gangemi - which made efficiency measures based on the dominant model a virtual recipe for overproduction, Italy presented another difficulty which America appeared not to suffer: "Besides the industrialists, there is another category of person interested in the proble and without whose good will it is not practically possible to apply any new organizational measures: I mean the

Italian working masses." [56] As things stood in 1926, Tarlarini argued, no Italian worker would not "feel an automaton" if time study men were to be suddenly introduced into Italian factories. It was therefore necessary that management innovations "be preceeded by a special moral preparation, to pursuade workers of the advantages that derive from these innovations, since it is not possible to implement them without the agreement of workers and their organizations." [57] For Tarlarini, this task of pursuasion was ideally suited to the fascist state in the form of the Corporations. [58]

A rather more challenging job of pursuasion regarded the industrialists themselves, since in Italy they "have an a priori repugnance for every chang in industrial organization, and (a fear of) anyone who would try to make such changes." [59]

Tarlarini closed his report by putting three reform proposals to the vote of the National Economic Council: courses in scientific management should be set up in all engineering schools and technical institutes; a massive government investigation should be carried out of production methods and the cost structure of Italian industry as a whole; and the state should provide an exemplary model for reform by implementing scientific managment in its own departments and offices. [60] The first and third proposals were approved by the members present, the second modified, in that it would be the Ente Nazionale Italiano per l'organizzazione scientifica (ENIOS) - headed by the engineer, collaborator with Gino Olivetti in the publication of the journal L'organizzazione scientifica del lavoro, and fascist enthusiast Francesco Mauro - to conduct the research program of Italian industry. [61] Since it would be financed and administratively controlled by Confindustria, the ENIOS investigation perhaps held out a less than disinterested promise for a critique of industrial organization in the peninsula which would furnish the basis for an effective program of economic reform. [62]

In the meantime, the limitations of financial and technical resources in Italy meant that a practical reform strategy depended on accepting the general principles referred to earlier proposed by a figure such as the American David Lubin. The process, however,would be gradual, and presuppose a number of conditions, one of the more important of which was pointed out by Giovanni Lume: "...one could say that (the Americans) attribute a good deal of importance to special considerations of a political order, which leads them to assume a reserved posture towards European nations, including Italy." [63]

Indeed, at the time the men referred to here were formulating plans for economic reform in the 1920s, the primary obstacles standing in the way of social rejuvenation appeared to be, as they had in fact always been perceived to be, "politics" and "speculation". The idea, later to be popularized by the American technocratic movement, of a permanent and destructive conflict of interest in modern capitalism between "technical" and "business" interests had long since been an intrinsic structural feature of Italian capitalism. The first victim of such a conflict was clearly corporate cooperation, and the application of technological criteria of industrial efficiency. To whatever degree it could be said that problems concerning social order and stability had been definitevely resolved since 1922, the engineer Ettore Cardani could, in 1928, still very much lament the absence of a corresponding level of "cooperation" in the area of "business":

> (In our industry) there is still jealousy and suspicion, doubts and secrecy, ideas that are more lucrative in a regime of competition. On the whole, there is in Italy a very individualistic mentality diffused amongst both producers and consumers. We believe, rather, that the country would be greatly advantaged if a system of alliances and cooperation were put into general practice reaching a point where machinery and plant would be supplied under the direction of a single authority, with centralized responsibility, and with constant technical, economic, financial and industrial monitoring.
>
> The public authorities, in making up contracts and offering concessions could play a large part in facilitating the formation

> of these groupings, which...because of the general level of efficiency effected through coordination and cooperation, would not be damaging to the interests of the client. [64]

Combined with the attack on the regime of competition between industrial producers, the clientelistic state in Italy also determined that a large part of what was perceived by industrial reformers as blocking rational economic remodeling in the country would be dismissively regarded as "politics". With the war, science and "americanismo", promising for once a real alternative to "politics", a social reform critique based on elaborating the contradiction inherent in the economic structure would find an amenable environment in which to take hold. It was logical that the loudest lamenting voices would be those who were most sensitive to the contradiction, and who clearly had most to gain from its elimination - engineers and technical personnel.

The figure whose technical competence gave him the right to assume the authority of supreme and "disinterested" social critic was not, however, the engineer of the past. Rather this was a newly emerging figure, embodying the confluence of capitalism and science, and therefore representing the active agent in economic growth. The engineer's function was not that of a captain of industry - that is, "financially co-interested" in the business or even one who simply conceived new technologies of functioned as works manager. Rather, he had to be professionally autonomous, specialized and operating independently of financial or particularist interests. In order to be able to fully contribute to national economic development in this capacity, however, the modern engineer had "in addition to being wholly competent in his specialized field, be well informed about techniques of industrial accounting, production costs and sales prices, and knowledgable about general accounting and banking operations." [66] Precisely because of this central position in providing for society's growth and needs - warranted entirely by competence in the material at hand rather than the favours of

politics - it was but a logical step to carry such reasoning, and its creators, to the highest level of social power:

> We will go even further.and ask ourselves: in the situation of incompetence and habitual incapacity that our parliament and bureaucracy have shown to possess during this war...if it would not be necessary to extend the concept of direct collaboratic between producers and engineers to the highest legislative and executive organs of the state...[67]

At the height of the war in 1917, one of the touchstones of the subsequent reformist social critique had already been clearly enunciated, articulated, for example, in an address by the industrial chemist Ettore Molinari to the Società Italiana per il Progresso delle Scienze (SIPS), entitled "The Importance of the Chemist in Modern Industry":

> I would like to cite an example, in order to give an idea of the mentality of more than just a few Italian industrialists immediately before the outbreak of the war. Some years back, when almost everyone had lost their head in speculation, I asked an important industrialist why he didn't have more chemists working for him, to be able to achieve a better technical standard in his firm. He replied that it would be useless to to that, since in a few hours at the stock market he could earn more than a chemist could produce for him in a year. [68]

The decades old problem of the "anti-industrial" mentality inherent in Italian capitalism was to have been eliminated forever by the lessons of war, and the real industrialization of Italian society. Parasitism, politics, and speculation would no longer have a place in the reformed order which however depended on changes allowing civil society to be managed according to industrial efficiency criteria. Clearly this could only be realized by appointing, on a massive scale, technical personnel to political positions. There would be a multitude of interests to overcome, and a deepl entrenched mentality of "anti-industrialism", but the structural changes already underway encouraged optimism for the success of the program.

Giuseppe Belluzzo took his natural place in the vanguard of such a movement. The year 1919 would be, he explained, in which industrial technicians would have to struggle against returning foreign competition and "against the threat of government interference in Italian industry."

Engineers would have to strike at the root of the problem of government by incompetents and corrupt officials, "renewing the (political) environment from which (these officials) emerge." [70] By 1919 the bases had already been laid for renovation, and there was no turning back:

> The war has initiated for Italy the era of producers and the adven of "competenti". Just as electricity has by now entered into every branch of technology...so the "competenti" must penetrate everywhere in the productive life of the country and in the management of public affairs... [71]

In the technical journals professional hubris was practically limitless, because it was of course they, the engineers, who would be the subjects of this social revolution: "The time of the experts is just dawning," the editorial article in Ingegneria Italiana explained in July 1918: "It is the century of politics that is setting." [72]

In this chapter I have tried to analyze both the long term structural problems and short term catalytic factors - the competitive pressures imposed by the American model of the "one best way" to manufacture industrial commodities - which combined to help raise the engineering model of reform to the level of political panacea.

In the chapter that follows a further mechanism of institutional reordering - the organization of production for the military effort during world war I - will be looked at through the perception of contemporary Italian reformers. For critics of the industrial order, the coordination of private and public resources during the war served both to reveal the structural weaknesses in the organization of production in Italy, and furnished a model of cooperative organization which appeared to correspond with and represent the institutional expression of an efficiency conception of social organization. Given

such a contemporary perception, it is important to examine the organization of the armaments itself - Mobilitazione Industriale - as well as the analyses made of the strengths and weaknesses of war time industrial organization, as perceived by conservative revolutionaries in the immediate post war period.

Chapter IV: Military Production and Corporatism

Chapter IV. Introduction

> If it would be to the war period that economic planners looked after 1929, it was also the experience of those years that had already inspired fascism for the regulation of political and social life.[1]

> The war has been such a profound revolutionary element, but even if our industries emerge more developed from the bitter contest, and generally more advanced in technical and financial capacity, the war itself left unaffected, profoundly unaffected, the industrial structure as a whole.[2]

Before the war in Italy, as in most belligerent countries, state intervention in the economy was significant but very limited. These interventions included management of public services such as the postal system, mines and forests, and the education system. Direct participation in the organization and management of industrial production however had never been part of the political function.[3] For a short period the war made industrial management a function of political organization, and in fact stamped the concept of industrial organization itself with a military orientation that has never left it.

For Vilfredo Pareto the war had destroyed forever the concept of natural law, substituting only "economic laws" in social planning and the organization and distribution of resources.[4] The military organization of the means of production, under control of the political authorities, was to have given new meaning to the notion of economic planning, the capacity to effectively control, organize and forecast economic behavior having been donated to society by the discipline and efficiency of military organization

In Italy, as Giovanna Procacci summarized, the war furnished the state with a greatly extended capacity to deprive citizens of rights and liberties to impose military discipline in the workplace, and to entrust the military directly with the power to control industrial production. At the same time corporatist arrangements for social pacification were being hacked out, and

conflict resolution through obbligatory arbitration agencies had its beginnings. [5]

The massive expansion of the administrative structure of the state was indeed remarkable. the number of civil servants having already tripled between 1890 and 1914 (for the previous thirty years the number had been static) by the end of the war the ministerial bureaucracies in Italy employed over half a million people. [6] The political and economic function of the state ha undergone a radical transformation, and agencies and regulatory bodies had been created anew to accommodate the massive movement of materials and human labour within the industrial system. "The state," Riccardo Bacchi wrote in 1919, "became the central motor of the nation's economy, the despotic regulator of the most varied economic activities." [7]

The means by which the state would be able to exercise such organizatior al power would be through the wave of industrial expertise entering into the management of the military effort. Government needed industry, and large scale producers, already experiencing overcapacity problems before 1915, would take the opportunity to exploit the blocking of international trade anc military contracts to mobilize previously underutilized capacity, and to some degree "italianize" the capital goods sector. "Without an iron hand," Luigi Albertini, editor of Corriere della Sera wrote, "the desired goal will never be reached...not only bullets have to be produced, but also the machines that manufacture the bullets..." [8]

The supreme executive organ of the state which would serve to both ensure the necessary allocation of resources and achieve some semblance of industrial autonomy was the Ministry of Arms and Munitions, under the overal authority of General Alfredo Dallolio. Although the organization and planni function of this ministry would have great metaphorical value in the subsequent fascist conception of social modelling, it in fact represented th familiar failures and contradictions of most efforts at economic planning

in competitive capitalism, at peace or at war: rather than operating primarily as a technical body to ensure the most efficient use of the limited resources available, the armaments ministry ended up being a centralized forum for the working out of "business" disputes in the collective race for spoils. In the corporatist universe, however, constructed of metaphors and symbols, "rationality" had entered the world of politics and economics through the planning potential revealed in the work of the weapons ministry. In reality, it would appear that the Trojan Horse of "business" had found its way into the labyrinth of public power.

War and Corporatism: The Organization of "Mobilitazione Industriale"

Amongst all the protagonists concerned in the First World War, it was promptly realized that it was a "type of conflict in which military conduct (would be) conditioned by the industrial, technical and scientific capacity of the belligerent countries." [9] To ensure that this capacity would be mobilized in the prosecution of the war, and in part due to the efforts of the subsequently discredited General Cadorna of the Caporetto disaster, a government decree was issued on the 26th of June, 1915, authorizing the state to "sequester" the relevant industries for military production, and submit production personnel to military jurisdiction. [10] In July, this move was formalized in the creation of the Undersecretariat for Arms and Munitions, shortly after to become a ministry in itself. Overall authority of the

ministry was given to General Alfredo Dallolio, who from 1911 had been in charge of engineering and artillery for the armed forces, and had earlier participated in the formulation of the 1910 artillery modernization program. This plan had projected closer relations between private industry and the military authorities through negotiating contracts directly with private producers and bypassing government arsenals.[11] Dallolio himself, whose formidable organizational skills represented an effective combination of military discipline and technical competence, was aware of the fact that "in an eventual war, the industrial capacity of the country would be determinate."[12]

The tasks of the Undersecretariat for Arms and Munitions as initially formulated were to procure raw materials, both domestically and from abroad; discipline labour; administer military contracts; and oversee administration all services relating to military production. Dallolio's perspective on how such an initiative could be realized, which stamped the entire history of the armaments ministry, was that maximum space should be left to private initiative in the execution of contracts, to which Italian industrialists, ever fearful of political meddling in economic matters, were eager to respond. Initially the organizational apparatus of the armaments ministry was rather slow getting off the ground: "The enormity and complexity of the technical-industrial problem that had to be confronted at the outbreak of th war...could not at first be put across to industrial leaders, since it was extremely difficult to foresee the duration and exceptional forms that the war would assume, and the unexpected push that it would give to science, mechanical engineering, physics and chemistry."[13] With Dallolio in charge, however, and profits, raw materials and labour control guaranteed by the military management of society, the complex of industrial power, to which war has proved so favourable from the time of this first "technological" one, started to move.[14]

The armaments ministry, and the Central Committee under Dallolio which was its nerve centre, set about the massive task of designating as "auxiliary" firms those considered essential for military production, and organizing the administrative machinery necessary to manage relations betwe these companies and the military authorities. A vast complex of administr-ative, technical and expimental services had to be organized. Having got underway in August 1915 with the nomination of technical specialist for explosives testing, the process continued to race ahead and the administrat to swell, culminating in July 1917 with the division of the ministry into seven main sectors: general services; services of the weapons production office itself; technical services of the ministry; general management of the artillery; military engineering; and production for the air force.

At this point Dallolio, who at the war's peak had more than 5,000 people responsible to him, was removed from overall authority of the Central comittee of "Mobilitazione Industriale", and was replaced by the electrical engineer Paolo Bignami, whose reform work on the financial structure of the electrical industry in the immediate post war years has already been discussed.[15] Evidently, the reason for Dallolio's removal from office was because of his habitual bypassing of the normal ministerial accounting procedures in his concern with maintaining high production levels which in particular emerged in disputes with Francesco Nitti at the Treasury Secondly, Dallolio had provoked the hostility of industrial employers meditating on post war arrangements, because of his commitment that the military management of production through the adminstrative structures of the armaments ministry would be an efficient model for the economic organ-ization of peace time Italy as well.[16]

At the ministry itself by the end of 1917, there were 1,708 "auxiliary" establishments working for the state, and at the war's end the number of firms had increased to 1,906. This included more than 900,000 workers, a large percentage of whom were women, newly introduced to industrial employ-ment. Initially, the tendency was to declare "auxiliary" only the larger

producers, but the selection criteria changed over time. As the war progressed, smaller producers were increasingly drawn into the administrative machinery of the ministry:

> since the regime of "auxiliarity" had proved itself effective from the beginning, there was a natural tendency to expand its range of operations. In addition, (the idea was) to not leave the smaller firms exposed to competition over personnel from the larger establishments. [17]

This referred to measures taken to contain labour mobility by removing the attraction of relatively better working conditions offered by the "auxiliary" firms.

During the course of the war, and as the number of auxiliary establishments increased, the Central Committee of "Mobilitazione Industriale became increasingly isolated from the direct management of production. The seven initial, and eleven final, Comitati Regionali di Mobilitazione Industriale were rapidly assuming ultimate authority over military production, and autonomy from the central authorities in the prosecution of the war. In practice this meant that "in the local areas, industrial interests were overwhelmingly predominant." [18]

As was the case in the initial formation of the armaments as a whole, the local level functions of the regional committees would be to control the labour force; procure raw materials for local production requirements; gather information on the efficiency of the manufacturers concerned; and, of course, execute military contracts in line with the overall production strategy of the central committee. [19] The ruling idea in the organization and administration of the arms ministry as a whole was extended down to the local level in the operational autonomy of the regional committees: "The dominant concept was to avoid any interference that would upset the freedom of movement of industrialists in the technical, commercial or adminstrative aspects of the management of their firms..." [20] However, as Vittorio Franchini - law professor at the University of Rome and secretary of the

inter-war preparedness organization under Dallolio's command, the Comitato per la mobilitazione civile, wrote: "once these principles and goals had been proclaimed, logically local executive organs had to be created, 'in direct contact with the men, the services and the questions to resolve'". [21]

The composition of the regional committes was to be as indicated in the original decree; as overall president there would be a general or admiral; two civilian members; two representatives from industry and two from labour, which, however, would have only a consultative vote in the decisions of the committees. In July 1917 the civilian presence was increas to six members, followed by a regulation which raised the maximum number to five for all the other categories. [22] There was no specific policy statement for the regional committees as a whole, and each one saw to its own needs an organization according to the requirements of local industry. All members and secretaries of the regional committees were nominated by the Ministry of Arms and Munitions, in concert with the War, Navy, Interior and Treasury ministries. [23]

From the outset, one of the primary functions of the regional comittees regarded the "labour question":

> The examination and solution of questions concerning economic disputes, and in general questions regarding the treatment of personnel, represented one of the most important and delicate responsibilities of the regional committees...Clearly, it was of immediate concern to investigate and promptly eliminate any cause of agitation of discontent by personnel involved in war work... [24]

On a technical level, at the beginning of the war all problems concerning production, raw materials and fuel supplies had been delegated to a Central Technical Office. This later gave way to more specialized technical committees, which however were subject to the authority of the regional committees in the carrying out of inspections on technical capacity and efficiency controls of the establishments under contract to the regional

committees.[25] A particular problem was hydroelectric power for industrial production - one which particularly preoccupied Dallolio - and apart from the question of exploiting available fossil fuel sources to the maximum, the issue of facilitating exchanges of energy between plants was a major concern. The individual regional committees enacted measures to organize consumption and distribution of electrical energy, and the task of working with local industries in determining efficient distribution of energy and possible plant modifications devolved to the local prefect of each regional committee.[26]

In addition to the technical and economic services carried out by the regional committees, they also intervened in a number of ways that directly or indirectly had an impact on the economic and social life of the area concerned. Auxiliary establishments often appealed to the administration of the regional committees to resolve any problems met in the operation of local industry. Such problems included mediating relations between producers working in the same sector, and, equally importantly, in the field of labour relations. It was felt necessary to make sure that "the feelings of workers were a constant reinforcement of the patriotic spirit", and "in harmony with those of the rest of the country."[27]

For industrial proprietors, "reinforcing the patriotic spirit" was not without its more mundane and wordly benefits. Although small workshops organized in cooperatives or consortia under overall government control proved most efficient for the production of bullets, only nine firms were technically outfitted to produce the required artillery (from 65 to 381 millimeter canons). Among these firms were Armstrong, Ansaldo, Terni, Breda (which before the war had been the major Italian manufacturer of locomotives Franco Tosi (which produced turbines and ship's motors), and of course FIAT.[2]

Opportunities were also on offer through the so-called gruppi di produzioni, which included medium sized firms, organized in some cases

geographically, and at other times following technical criteria. These units of coordinated production were headed by arsenal directors or by entrepreneurs of the relevant industries. The electrical engineer and entrepreneur Dante Ferraris,(who sat as a member of the Central committee of Mobilitazione Industriale, as well as participating as an "industrial member" to the Turin regional committee) was in charge of a gruppo di produzione of twenty-five companies. Through a different production group, Luigi Orlando of the powerful Società metallurgica italiana coordinated his own firm's output with that of the Società metallurgica Corradini of Naples and the Società Trafilerie e Laminatoi of Milan. [29] Neither did Pio Perrone of Ansaldo, Arturo Bocciardo (a member of the Genova regional committee, president of Terni and subsequently ardent fascist supporter) or Attilio Odero, also of Ansaldo, waste time in taking advantage of the situation. By September 1915 they had already united to form the Società ligure fabbricazione proiettili.[30] Similarly, Luigi Orlando and Mario Rosello of Credito Italiano had seen to the formation of the Società italiana generale per munizioni ed armi, with a manufacturing base at Casaralta in the provinc of Bologna, within six months of the declaration of war. [31] "Taken as a whole," Luciano Segreto summarized, "weapons manufacture was considered... good business." [32]

One would assume from reading accounts of production organization durir war time like that of Vittorio Franchini cited above, that there were considerable conflicts of interest to overcome in stabilizing relations between the "auxiliary" firms under the administrative "general staff" of the regional committees, and the regional committees themselves. In fact, the administrative and technical work of the regional committees - in assigning orders, mediating contracts and labour relations with the firms involved - was in large part an entirely self-referential procedure. Sitting as either "civilian" or "industrial" representatives on the various regional committees were most of the figures whose efforts in both

industrial reform and economic management in early twentieth Italy had played such a central part in the long process of "industrializing" political discourse, while leaving political society intact, a process which this thesis has tried to recount. On the Rome regional committee of the Ministry of Arms of Munitions were the subsequent president of the Associatio of Italian Engineers and fascist enthusiast, Ulisse del Buono; Pio Perrone; scientific management expert, senator and professor of naval engineering in Rome, Luigi Luiggi; Bocciardo, as already indicated, sat as an "industrial" member of the Genova committee; in Milan there were the engineers Carlo Esterle of Edison, the reformer Luigi Pontiggia, whose work has been looked into in connection with the Comitato scientifico-tecnico; Angelo Salmoiraghi who was part of the editorial staff of L'industria; and the engineer/entrepreneurs Giorgio Falck and Ernesto Breda. Gino Olivetti, Dante Ferraris, and the subsequent president of the Italian Standardization Institute and corporatist enthusiast Enrico Marchesi operated in Piedmont. And on the Central committee of Mobilitazione Industriale, the engineer-reformers Cesar Saldini, Paolo Bignami, Ugo Bordoni and Dante Ferraris were present, as was the post-war president of Confindustria, Giovanni Silvestri: "Here one is dealing with an apparatus that contains two new elements with respect to any other structure of the state," Paola Carucci wrote in considering the totality of relationships operating at the core of the armaments ministry: "from endowing a single organization with every aspect of the expertise... inherent in the complete cycle of industrial production for the war, on through labour problems and relations with the firms concerned." [33] This process of "occupying" the state with industrial expertise, combined with the autonomy from political interference which allowed such enormous profits to be made, meant that for both engineer/reformers and industrialist working side by side in the various committees of Mobilitazione Industriale, war indeed was "fulfillment." [34]

In part, these profits were guaranteed by the legal measures passed

by the Salandra government on the day the war began for the rest of Europe, 4th of August 1914, which exempted the branches of the state administration directly involved in the affairs of war (the ministries of War, Navy and Transport) from the regular accounting procedures and controls of the central Corte dei Conti. And in part, they were made possible by the autonomy permitted industrial producers by the disorganization and technical ignorance of the political authorities. Very often contracts were simply signed by the company concerned after production had already got underway, without the prior approval of the government. Prices, delivery times, and so on were determined at will by the industries, and many agreements were simply verbal. [35] Contracts were nominally the responsibility of the government technical office of the Undersecretariat of arms and munitions, headed by General Clavarino. However, apart from a general lack of political coordination between the various branches of the office, "a profound ignorance prevailed in the offices of the state about effective production costs..."[36]

In September 1918 - because of the industrialists opposition to the preannounced state assumption of control over orders, prices and profits, mediation with the banks and a stated policy of imposing a wage scale [37] - the Ministry of Arms and Munitions was dismantled. In its place was set up a general commissariat at the Ministry of Transport, under the engineer Cesare Nava. In November, the commissariat was transferred to the Ministry of War, and Nava's efforts to reorganize and centralize the functions of the armaments ministry were effectively resisted by the powerful figures operati through the regional committees. [38] A month later, Nava's commissariat was itself dissolved, and its responsibilities were passed to the Treasury Ministry for dealing with contracts still pending. Undersecretary at the ministry was Edison's Ettore Conti, who immediately assumed the role of president of the executive board of the inter-ministerial junta established to liquidate contracts still underway. [39] The work of this group, of which

Arturo Bocciardo was also a central figure, rendered the entire structure of Mobilitazione Industriale redundant, and the remaining administrative servic of the organization were formally disbanded in March 1919.

Immediately before its complete dismantling, a debate began to develop within the central committee of Mobilitazione Industriale on the post war rol of the state in industrial affairs, and the significance of the organization structures of the armaments ministry in peace time society. The possibiliti considered were to assimilate the adminstrative functions of Mobilitazione Industriale into other ministerial organs; expand the role of technical people in public works, transport and the economics adminstrations; substitute technical ministries for military ones; and transform the regional committe into employment offices. [40] In practice, the central offices of Mobilitazione Industriale had never had executive power in economic administration ascribe to it by planning enthusiasts. Administrative offices expanded rapidly throughout the war, but without effective coordination, and it was not until after the military disaster of Caporetto in late 1917 that Italy even had a centralized war committee, "to decide on all questions regarding the relationship between the civil and military authorities." [41] The administration of the war effort reflected well the structure of power in society - fragmented, decentralized, uncoordinated and unplanned, with pockets of local economic strength left autonomous to exploit administrative disorganization, and wholly determine the terms of their relationship with the public authorities:

> The executive...reinforced its powers on an institutional level and enormously increased its presence in society. However, it was not able to create the appropriate instruments to coordinate decisions, nor achieve a level of organization capable of putting into practice the decisions themselves. [42]

For Labour, Mobilitazione Industriale did however represent the first experience of corporatist management in Italy, and gave a strong push to introducing functionalist concepts of labour relations into Italian industry With Mobilitazione Industriale came new procedures of defining wage levels,

reached independently of the caprice of individual bosses or proprietors. Also the first labour contracts to be conceived on a national level for whole industries were first introduced during the war, and were the roots of the subsequent fascist conception of the "collective labour contract". A rudimentary form of unemployment insurance and escalating wage scale was another innovation of war time production organization, as were fixing general standards of health and hygiene in the workplace. Finally, the general principle of triangular negotiations on labour contracts between representatives of government, industry and labour were first experimented with in the years of combat.[43] Clearly these innovations in labour relations were in no small part due to a fundamental shift in the composition of the workforce, mobilization for war having introduced thousands of women and peasants to the experience of industrial work.

For industry, apart from greatly increasing its policy vote in the political life of the country, the armaments ministry had provided a customer who imposed no conditions and never haggled over price.

To the governments involved, particularly perhaps the Italian state - since it was during the war that the traditional and familiar economic problem of raw materials became a question of national survival - the war had demonstrated the need to ensure the stability of particular industrial sectors. The conflict had revealed that interruptions in trade, in particular for a technology importing economy such as Italy's, could cripple all forms of industrial production. Industrial autonomy and stability had become a political question of prime importance, and the adminstration of public power would have to play a much more active role in ensuring such stability.

On a pan-European level, this problem was dealt with at the Paris Economic conference in 1916, and following a motion prepared by the British Committee on Comercial Policy, mines, ironworks, engineering industries, the electrical industry, naval construction, textiles and the chemical industry were all declared essential sector for the political survival of a

nation at war.[44]

The other side of the question was that the race to profit from government demand had led to excess expansion, often in obsolescent technologies, and in the largest companies such as Ansaldo and ILVA, the immediate post war problem of overcapacity, compounded by the inevitable inflation, was intense.[45] Out of these more immediate conflicting interests and tensions, emerging within a traditional polemical context of political reform which placed technical considerations at the centre of social causation, there arose a revitalized reform discourse, which began amongst crusading engineers having "organization" as their banner, and made its mark on a nascent group of conservative authoritarian revolutionaries.

The Legacy of War: The Socialization of Production and the "Decline" of the Bourgeoisie

For reform minded Italian corporatists, the industrial process of human slaughter that lasted from 1914 to 1918 served primarily to verify the contradiction that they had invented and diffused in the two pre-war decades: the contradiction between "politics" and "scientifically organized industry" on the one hand, and the incompatibility of "industry" and "speculation" on the other. The institutional and technical changes induced by the war were to have

indicated the way to resolve these contradictions, which had traditionally been perceived as the constraints on real development in Italy. Engineering science, organized industry, and a reformed political administration would therefore form the principal reference points of a self-correcting and self-transforming cycle of social causation that, through their interaction, would finally serve to harmonize conflicting interests, resolve the traditional contradictions that lay so deep in the society, and liberate Italy from the truculent capitalism of the international division of labour.

Whatever one's political position during and after the war, reformers and commentators in the second decade of the century were almost unanimously agreed on the fact that something fundamental in the social and economic organization of society had been permanently changed by the years of struggle. On the political left, Francesco Nitti optimistically explained in 1917 that the war "is the introduction of an almost communist regime," and presaged "some real socialist forms of production, distribution and consumption." [1] Similarly, Arturo Labriola, marxist theoretician and socialist vice-mayor of Naples, pressed for a revised socialist strategy in light of the breakdown of rigid and traditional political categorization that the war had effected: pacifists had become militarists, republicans monarchists, free traders protectionists, and so on. [2] Moreover, Labriola observed, it was precisely this collapse of political ideology that had favoured the triumph of socialism,

since only socialism as a program of economic organization corresponded with the dominant trend in industrial capitalism - the full employment of productive capacity. In large part, capitalism itself could be defined as the systematic waste of resources, but the new civilization of mass-production was carrying society in the opposite direction. The old socialist dream of capitalism caving in on itself, creating the conditions for its own self-transformation, was finally being realized. The motor of change, however, was not emerging from outside or at the margins of the system, but from the very core, from the physical means by which surplus was created in industrial capitalism: technology and not class struggle was the means by which the old system of waste of human and natural resources would be transformed, or rather would transform itself. The only important fact was to produce, and the dynamic logic of the process would itself invert the priorities of the system:

> The concept that dominates...all forms of socialism is this: that economic forces must be used for the benefit of society, and that the goal of society is the maximum development of the individual. From this can emerge: total communism, partial collectivism, workers control, cooperatives, and also -why not? - private enterprise itself, provided that it implies full economic and human remuneration of labour. All this, however, is completely beside the point. What is important is only that neither human nor material resources be wasted. [3]

From within the military apparatus itself, the secretary general of the central committee of Mobilitazione Industriale, Major Enrico Toniolo, began an analysis of the war patrimony with the proud observation that Mobilitazione Industriale "demonstrated that the genius for organization is not just a speciality of certain races." [4] However, because of the relative success of the Italian authorities in organizing for the production of arms, new problems, particularly regarding labour, had arisen which would demand the continued application of administrative and organizational lesson learned from the war. Citing a report on women workers in the La Spezia arsenals, Toniolo was disturbed by the information that amongst the workers

there was "an air of continuous festivity," [5] caused by previously unknown wage levels and working conditions. On visits to numerous auxiliary centres of military production, Toniolo had been struck by the extraordinary comfort and "vita allegra" of certain categories of workers.

Editorial comment in Ingegneria Italiana also expressed restlessness about this phenomenon amongst the arsenal workers, in a review of an article by Attilio Cabiati (subsequent author of the preface to the 1933 Italian translation of Allen Raymond's What is Technocracy?) in the journal Secolo:

> As a consequence of the war effort, people of all classes, sexes and ages have been taken with a compelling need to "enjoy themselve more" - that is, to earn more and work less...a completely artificial sense of wealth has been created by war production...Instead the fundamental requirement of the present moment is to work more and harder. [6]

In the previously cited article, Enrico Toniolo's main preoccupation was for what would happen at the war's end, when the problem of post war unemployment became a real threat to social and political stability. [7] As a means therefore of ensuring the survival of the social order, Toniolo referred favourably to a report by the engineer . Dante Ferraris on the question of post-war unemployment, who had advocated provincial and comunal government intervention in the form of public works projects. [8] And it was in the conception, organization and implementation of these projects that the administrative structure of Mobilitazione Industriale could serve immensely in post-war reconstruction. Toniolo himself was very clear on what was required: "The state, now and in the immediate post-war period, has not only the interest, but one could also say the duty to favour, assist and discipline any work or initiative, both public and private, that has as its aim the complete exploitation of natural resources..." [9] This would include wide-ranging programs for road and rail construction, exploration of alternative fuel sources, port development, and the institutional mechanism through which such projects could be organized was already made to order in the committee and departments of the established armaments ministry. The

main functions of these various offices would be as technical consultant and coordinator of the projected development program, as well as to exercise an important role in mediating capital-labour disputes. In other words, the peace time Mobilitazione Industriale could act as a type of permanent "advice office", not supplanting existing economic ministries but operating in parallel as a competent authority, a sort of civilian "general staff" of national economic management:

> Industrial organization of the future will have...to take stock of the lessons of the war...of organization and discipline...If it is true, as everyone claims, that a nascitur novus ordo will emerge from this war, it is clear that the new order will have to have new bases, constructed with new materials - that is to say, with new men...[10]

In general, the mobilization process was viewed as having presented the possibility of national economic liberation, and to have provided the means which would allow Italy to participate in the wave of industrial transformation that would sweep Europe. An American observer, Dwight T. Farnham (consultant engineer, vice-president and director of the Society of Industrial Engineers), who had visited FIAT, the Ansaldo shipbuilding and steelworks in Genova, and Breda locomotives in Milan in 1920, floridly described for his compatriots the transformation that was underway:

> America had eighteen months of intensive education in industrial efficiency. Europe had nearly five years. She was 3,000 miles closer to hell, and above the whir of the machinery there was always the roar of guns. Conservatism and traditional inefficiency break down very rapidly under such circumstances...The time has passed when the American manufacturer can vent the spleen gathered in the art galleries and the cathedrals, through which his wife has dragged him, upon the antiquated factory buildings of Western Europe. Industrially, Europe has arrived...[11]

In Italy, with its history of regionalism, clientelism, cultural individualism and administrative anarchy, to "arrive" industrially meant much more than technical innovations that would lower production costs and increase industrial efficiency.[12] Indeed, the triennium of industrial slaughter would allow corporatist reformers to elaborate their vision of a new

"administered" social order, which promised to abolish "politics" from the organization of social power:

> The basis of the fascist state can only be the new ideas and new reality created by the war and the victory...The tradition of the kingdom of Italy and of the Italian people brought together in a unified state began in 1915...modern man is no longer either citoyen or homo oeconomicus, but is the cittadino produttore. [13]

Cesare Nava, on the other hand - whose commissariat at the Ministry of Transport had been a temporary substitute for the Central Office of Mobilitazione Industriale after the latter's dismantling in 1918 - was more circumspect in his assessment of the armaments ministry's record as a sort of institutional expression of the engineer's function as production mediator. Despite reservations, however, Nava shared the widespread optimism for the planning potential of the organizational model. [14]

Nava began his comments by expressing satisfaction with the regional committees' work during the war in resolving disputes between capital and labour. When the increased cost of living threatened to develop into a major problem, and possibly cause interruptions in production, the representatives of the regional committees were usually able to intervene as mediator and bring order to the situation. [15] The war, Nava believed, had taught everyone a "friendly solidarity": everyone had a right to expect more from society for their sacrifices, but, in addition, both capital and labour had learned their duties towards the country as a whole. [16]

On the important question of industrial conversion, Nava considered the technical bodies of the arms ministry to be in a position to make a significant contribution to the organization of the peace time economy. The problem, however, was not entirely technical, and a wide ranging social reform program to accompany the process of technical reorganization would be essential, "to recognize a greater participation of labour in the profits of industry." Mobilitazione Industriale, as it had functioned during the war, would however not be up to the task. Nava was forced to agree with the two main criticisms launched against Mobilitazione Industriale: first, that it had lost its

"industrial" character and become a top heavy bureaucracy; and secondly, that the Central committee did not operate as the highest regulatory organ of the ministry, but simply as a forum of appeal for the working out of disputes among particularist interests. The Central Committee never possess the character of an autonomous, executive regulatory organization, which in theory it was designed to be. [18]

In the post war competitive environment it would be particularly important to make considerable investment in the location or synthesis of new raw materials, and in this task the technical offices of a reformed Mobilitazione Industriale could play a vital role. Nava's proposal [19] was to create two separate "juntas", one technical and one with "economic" functions. Together, these planning offices would form a permanent "planning office" in the heart of the reconstituted Comitato Centrale. [20] In addition Nava suggested, it was important that some representatives of the Central Committee should be present at the periodic meetings of the Ministry of Arms and Munitions when problems concerning the iron industry, explosives, and questions of raw materials acquisition and their allocation were discussed. [21]

Essential to the success of such a plan was that the executive organs of Mobilitazione Industriale be formed into a single, streamlined organization which required a degree of coordination that the arms ministry had never possessed. And, as Nava concluded, it was precisely the autonomy allowed the regional committees - in allocating raw materials, labour placement, organizing local transport of materials, and so on - that had impeded centralized coordination of the industrial effort from being realized. [22]

Nonetheless, the notion prevailed that a new consciousness of the value of organization and functional hierarchy had been diffused in the society. Although, as has been argued here, the requisite technical reforms had been anything but realized even by the late 1920s, for men like Nello Quilici,

editor of the proto-fascist daily of Bologna Il Resto del Carlino and corporatist enthusiast, "the war gave the bourgeoisie the first profound awareness of its own inadequacy." [23] Writing in 1932, Quilici was satisfied that the "old" bourgeoisie had been long since moribund: "The war appeared to realize (the bourgeois) dream. Instead, it was its tomb." [24] The hegemony of science, capital, technology, corporate hierarchies - and the end of the old bourgeoisie and its social flaccidity - was complete:

> To survive (economically) associations must be formed; and forming associations signs the death sentence of (bourgeois) individual freedom. (The bourgeois) is the victim of the same civilization which he himself created: intensified, impersonal, standardized production, and increased consumption and communications networks which unify the globe into a single market. [25]

Perhaps among the most important of the consequences of the new civilization inaugurated by the war regarded capital-labour relations:

> The imperious technology of the new industrialism brings the two antagonists closer together, tying them to the same pain and the same glory. Without even being aware of it, both must obey the same laws. What difference does it make if they hate each other? The day will come when they will fully and willingly collaborate. [26]

Walter Rathenau was praised for having the courage in the immediate post-war years to suggest disciplining private initiative through state intervention in the economy, and to proclaim an overturning of economic laws that the war had imposed on industrial society: "Today some of his writings have a strange flavour of prophesy, the virtue of having foreseen bolshevik and fascist civilization." [27]

Despite such claims, the technical preconditions for the "new civilization" in Italy were never fulfilled during the fascist period. Notwithstanding enthusiastic outbursts, such as that of Corrado Gini in 1921 that "a few years of war caused Italian industry to develop enormously, and gave labour an education that could never have been hoped for in many years of peace", the traditional tensions created by the lack of syncronicity between economic development and a particular social and institutional "backwardness", continued to tenaciously characterize the society. [28]

In reality, as Carlo Lacaita wrote, "the war period constituted not only an extraordinary occasion for industrial development, but also an enormous increase in the bargaining power of entrepreneurial forces." [29] For social reformers working closest to the structural changes underway, however the imposing entrance of industry into a dominant position of social power meant something more vast and important. The field was being prepared for the long awaited reforms that would cancel out the uncertainties and contradictions of the old capitalism - clientelistic, speculative, dependent, "anti-industrial". What was required was simply to leave the planning and organization of the new social order to those most competent to manage the job at hand. The time of the "producers" had arrived:

> To you, engineers of Italy...do not let it be forgotten that every problem, even moral ones, originate in the competition between classes and nations, and that, much more often than it may seem, such competition has an economic origin...Production must increase once industries have been selected and established, their management, in every particular, must be the job of the engineer, as must be decisions about the division of profits between capital and labour...No one can foresee events, but the engineers have the power to dominate the future. Above the silence and cowardice of voices which, even yesterday, dominated and intimidated, the wonderful audacity of fascism sings...Whatever happens, many of the forces for controlling the future are in your hands, engineers of Italy... [30]

All would depend on meeting a single, undeniable condition:

> Industrialists who believe they can do without engineers, while invoking tariff protection, will have to be pursuaded that times have changed. They must get organized or close up shop; either give technology and science their due place in industry, as the Germans have done, or change profession. We could be deceiving ourselves, but it is our feeling that the time of industrial bankers and speculators is finished. [31]

Chapter V: Class Struggle, Engineering Ideology and the Politics of Order

Chapter V. Introduction

> In the past few years, the engineer's range of responsibilities has gone far beyond the merely technical...The concepts of "minimum work" and "minimum cost"...have been applied to other than purely tehhnical problems. By applying these concepts to human beings the engineer has shown himself to be a competent organizer; by applying them to finance he has demonstrated his skills in the relolution of financial problems.
>
> The engineer has therefore proved his ability to assume managerial authority over the most administrative tasks, and to be able to usefully contribute to the political life of the country. Despite this, few engineers occupy government posts, and one still sees important work, for example in the Ministry of Public Works and Transport, done by lawyers. (To arrive at these positions of political power) and to complete his education, the engineer must elaborate and extend his studies to include those of a more social character. [1]

> A political movement is...in resurgence...our journal came into existence primarily to stimulate the formation of a theoretical/political consciousness amongst our collegues... if our political leaders have no technical competence at their disposal, the fault is ours, of engineers...we have too often let technical questions fall into the hands of non-engineers. Moreover, we ourselves have not entirely grasped the politcal content of our work. [2]

Before 1915 in Italy, technical reform of the inapprppriate industrial structure and the transformation of culture and classes were, without qualification, insisted upon by social reformers as complementary and interdependent parts of a single process of redefining Italy's role in the international marketplace. In that year two events took place - one very humble, one very dramatic - which would help to inject new life into this social reform discourse, which persisted in viewing the technical expert as the bringer of hope and change to the society.

The first was the publication of Frederick Taylor's Scientific Management in Italian, which took on a particular significance given the military context in which these principles of organizing production

were introduced; the second was the social and economic reorganization demanded by the planning of the war economy itself, which, apart from implicating the public authorities in the management of resources, also, and perhaps more importantly, appeared to offer the state the organizational tools and people with which to exercise this new function.

For reforming engineers, the lesson which emerged from the drawing together of these contemporaneous events was clear: not only had they become the key figures in the organization of human and natural resources at the level of production; they were also the only elements possessed of the capacity to make rational decisions on the organization of classes and power in society.

In the immediate post war world, a new and decisive element emerged to provide this technocratic discourse with an urgency that helped to draw it out of a primarily economic framework of analysis and into a "social" one: the workers' control movement. For engineers, class struggle and the threat to social order represented by the workers' control movement - since it undermined the authority assumptions of the capitalist division of labour and therefore of the engineers themselves - furnished the final push to the articulation of a technocratic/corporatist conception of social organization.

This chapter therefore, the final one of the thesis, will consider the formation of engineering ideology in the context of post war capital-labour disputes over control of the state and production, and the engineers' response to the corporatist-fascist vision of social order which arose out of these struggles. The final section, which will look at reform prescriptions articulated from

within the structure of the state administration,itself, is intended to suggest a representation of the merging of engineering and political-administrative perspectives on social reform for Italian society, and as a mechanism of transfer of engineering models from the industrial to the political sphere of discourse.

Class Struggle and the Re-Articulation of the Engineering Ideology: The Vision of Pietro Lanino

Within the engineering community in the immediate post war world, one of the more conspicuous vehicles for the expression of engineering ideology was the journal Ingegneria Italiana, a weekly engineering magazine published in Rome from 1918 to 1922. Founded and edited by the railroad manager and technician from Turin, Pietro Lanino, the reform enthusiasm and efficiency problematic expressed in Ingegneria Italiana were molded in large part by the technical complexities and politcal struggles in the transport sector itself, a sector which straddled the worlds of private industry and public management. Lanino's analysis of the management

of the railroads is important background to understanding the evolving technocratic conceptualization of political organization within the engineering community, and will be examined in some detail in the paragraphs to follow.

Lanino was born in Turin in 1870, and studied civil engineering in Bologna, graduating in 1893 with a thesis on the application of electric traction to the tunnel of Censio. Following a year of work as a technical assistand at the University of Bologna, he spent one and a half years at the Central Technical College in London as a laboratory assistant in the electrical engineering department. [3] Returning to Italy, he was employed until 1902 as dirctor of works and planner for the Società delle Ferrovie meridionali for the Adriatic network of the rail line, working primarily on electrical traction installation. At the Paris International Exposition he was awarded for his achievements with the company, having been responsible for installing 105 kilometers of electric traction on the Adriatic network. [4] From here he worked mainly as a consultant in the field of electrical railroad technology, for the Swiss owned Tecnomasio Italiano Brown Boveri and the Società Dinamo. He was also part of the management of the Società per l'elettrificazione ferroviaria del Mezzogiorno, and "during the feverish development of the artificial silk industry in Italy", [5] he founded and ran the Artificial Fibres Industrial-Technical Research Office.

As the eulogy in the Rivista Tecnica delle Ferrovie Italiane - a journal founded by Lanino himself in 1912 - explained in 1930, in all projects with which Lanino was involved, "he had a preponderent part in the execution of the job, either directly as manager or as consultant." [6]

His first interventions as organizer of his own corporate group began in 1895, when he founded and sat as president of the Società Tecnica Emiliana, whose headquarters were established in Bologna. In 1902 he was responsible for setting up the Bologna section of the Italian Electrical Engineering Association, of which he was president until 1906. From here Lanino moved into the administration of the national organization of railway engineers, the Collegio nazionale degli ingegneri ferroviari, where he again sat as president from 1910 to 1922. During the war he managed and edited two publications, the Corredo del Soldato and the Comitato nazionale per il munizionamento, both published in Rome.

After the armistice Lanino submitted a major report to the government, already referred to in this thesis, on the structure of Italian industry, the implications of war time industrial organization, and necessary paths to follow in economic reform. [7] In these immediate post war years, corresponding to Lanino's editorship of Ingegneria Italiana - the journal which, taken as a whole, represents the first systematically developed statement of government by technicians that I have found in the technical literature - Lanino was also continually active as an engineer and analyst in the railroad sector, submitting a report to the College of Engineers in 1920 entitled Railroad Strikes in Italy. [8] This extensive polemic on the

situation in the Italian railway system before and after the war is an important reference point in explicating the technocratic vision propogated by Lanino from 1918, and will be looked into in more detail slightly later.

Later on in the 1920s Lanino studied the problem of coordination and competition between rail and automobile transport for the International Chamber of Commerce and the International Association of Automobile Clubs, spending a year from 1928 to 1929 in the United States researching the issue.[9]

For Lanino, the war was the ultimate and tragic testimony that "politics" and economic efficiency were incompatible conceptions in the running of a society, and that the state was by its nature incapable of ordering the world of industrial production in a rational way. Already professionally predisposed to regard the efficient political management of economic resources an absurdity and a contradiction in terms, Lanino and those like him saw the war largely in terms of an enormous and unassailable demonstration of their views. That private industry could have actively participated in the efficiency errors of war time industrial organization, indeed that private interests could be largely responsible for post war economic economic problems resulting from their own "disinterested" management of the war economy, was perhaps a less important question to be asked in 1918. Attention had been drawn to the state and everything had become political.

"State control of an industrial activity," Lanino wrote in his report to the post war Commission on Industrial Production, "will never lead to a better output. Nationalized industry will always produce more expensively than private industry. This must be the point of departure...the whole present tendency to nationalization is essentially a movement to bureaucratization and parliamentary interference."[10] The conclusion of the October 1918 report was that the state should play the part of encouraging private industry, not substituting for it, by stabilizing the tax system, remove fiscal burdens, and provide society with the "tranquility"

required for a vigorous private sector to develop. [11]

Industrialists themselves were not without fault as well, and in a report submitted to the Tuscan College of Engineers in October 1919, Lanino emphasized the efficiency consequences of the general lack of coordination and planning in the industrial structure. [12] Industry had certainly profited from the war, Lanino pointed out, particularly the metallurgical, engineering industries and those complementary to explosives such as the chemical sector. However, through excessive exansionary initiatives and financial operations, many industrial takeovers and mergers had taken place without reference to complementarity of process or product. Though it was a truism of the time that "the tendency to great industrial concentrations is a characteristic and necessary phenomenon for the progressive development of our industrial economy", size was not the only criterion of efficiency, and the formation of industrial groupings had to be informed by a production rationale as well as a financial one. [13]

For Lanino, the war time slackening of competitive discipline and attraction to easy gain was also manifiest amongst labour. The higher real salaries allowed workers in the frenzied production and expansion of capacity of war time was not "compatible with the secure formation of an industrial consciousness, and neither with a normal, peace time industrial economy." [14] A particular characteristic of the new industrial regime, Lanino argued, especially for those directly involved in military production, was the reduction in workers' output, precisely at a moment in which workers' buying power and demand for consumption articles was increasing. The underlying reason for this fall in unit output was because of "a gradual absorbtion (of workers) in the direct management of the largest industries and the transport sector," which had created "a general perplexity amongst our industrialists." [15]

As Roland Sarti observed, Italian employers' "perplexity" in the face

of Labour's assertion of strength in the immediate post war years was rooted in the traditional paternalism of capital-labour relations in Italian industry:

> At a time when employers in Western Europe and America were beginning to accept and welcome the advantages of collective bargaining, Italian employers reacted to labour unions with the gut reaction of first-generation capitalists. They considered membership in a labour union an act of personal betrayal. 16

Given that the majority of American workers would have to wait until 1935 and the founding of the CIO to have organized representation in industry, Sarti's comment needs to be taken with considerable qualification. Having noted this, however, the undoubted tradition of paternalism in Italian industrial relations, and the logical militant response by employers to workers' claims in the post war world, in no small part contributed to the rapidly forming self-image of the engineer as the "disinterested" third element in capital-labour relations, corresponding to his mediating role between the means and relations of production in the industrial workplace. In the capital-labour conflicts emerging at the war's end, "

> industrial managers in particular have a duty and a responsibility to intervene. And the class of engineers has the right and obbligation to consider themselves the highest and most disinterested expression of management. (Engineers) are the connecting element...between industry and labour. 17

On a technical level, the race for spoils and political mismanagement of war time production if anything retarded technological progress in Italian industry. Lanino reiterated the traditional concerns of technical reformers regarding the question of and efficient industrial power network, and stressed the negative effects of war time industrial organization in this sector:

> For a country like Italy, electrical energy should be regarded, not as a simple surrogate for coal, but as a fundamental and decisive factor in our post war industrial economy...the entire structure of our industrial organization must be transformed, taking on an electrical physiognomy. 18

Before the war, Lanino argued, the production and distribution of electrical

energy represented one of the financially strongest sectors in the economy, and was the most efficiently coordinated and integrated. During the war, however, the industry was neglected, exemptions and financial means were denied it, and entrepreneurs took the easy route of fixing artificially high prices and tariffs which discouraged development and innovation in the industry. A crisis had been averted, or in any case was not immediately obvious, because of the high incidence of fixed costs in this sector, which meant that a negative balance in operating costs would not be immediately evident.[19] It would have to be the responsibility of a reformed state in the post war economy to provide for reconstruction and development of the energy sector for industrial consumption.

In the other areas of primary importance in the post war economy - chemical research on raw materials available in the Italian soil and fuel alternatives - the same problem had appeared: extraction of indigenous fuels (pyrites and lignite) had tripled during the war but quality had not improved. Systematic and efficient exploitation of sulphur deposits had be hindered by lack of government initiative, particularly as regarded legislative measures to resolve conflicts between property owners and industrial investors. Dealing with such problems at a legislative level, and opening up space for investment in the synthesis of raw materials and expansion of the chemical sector required urgent attention in the post war world: "This is our great field of industrial action."[20]

Finally, Lanino turned his attention to the transport and communicatic sector, the one in which he himself had been directly engaged as engineer and manager, and which completed his portrait of social and economic mismanagement in Italy. A marine transport sector, Lanino claimed, had never really existed in Italy, even before the war. This crucial area of economic activity in the peninsula, almost an island in terms of transport and communications,

> has not operated as industry, but as speculation. This is one of

> the deviations of the war time mentality and...of the post war period. [21]

As was true for the entire industrial structure in Italy, in this sector as well there was too much industrial "individualism", and too many overlapping functions and services in the merchant fleet. [22] The transport sector in general was a particularly sensitive area of controversy, because of its "industrial" character, although by its nature it implicated the public authorities in its day to day management.

Lanino's major statement on the problems of the transport sector, the day to day struggles of which provided the backdrop to his editorials in Ingegneria Italiana calling for social management by the "third element", was his report to the Collegio Sindacato Nazionale degli ingegneri ferroviari italiani, of which he was president, in 1920. "Railroad Strikes in Italy" is a long,polemical narrative of the disorder in the Italian transport syste from 1902 to 1920, which in the end arrived at the same conclusion his contemporary Henri Fayol would reach in a study of the French postal system commissioned at about the same time: "Whenever the political authorities have interfered in questions regarding railroad personnel, a shock has immediately been felt in the system, with its consequent relaxation of discipline." [23]

Lanino's analysis begins in 1902 with the first political intervention under Giolitti's government, in the industrial relations of the Italian railroad system. In Lanino's view, this intervention, following the strike of that year and the political imposition of pay standards, implicitly suggested that private companies were incapable of resolving internal disputes on their own:

> This intervention of the state in management-labour relations was not only a decisive blow to private management of the rail system.. which led a few years later (1905) to government takeover of the system. It was also a cruel blow to the entire disciplinary structure of our railroad sector, and established for the first

> time the principle of political interference in disputes between rail personnel and the administration... [24]

The eventual "fatal" entry of the government in management of the network was prefaced, in September 1904 and July 1905, by a series of slowdowns and strikes. In March 1904 the Minister of Public Works Tedesco had proposed, in response to stoppages, a law which would classify railroad personnel as "civil servants", and therefore bring employees under jurisdiction of the state in the event of strikes. With the cabinet change of February 1905 additional disciplinary clauses were suggested, article 71 of which proposed that promoters or organizers of disruptions that involved three or more persons would be punished by suspension of one to three months. In addition the proposal stated, if the organizers concerned were successful in creating a work stoppage, they would be subject to incarceration of six months to a year.

The "obstructionism" and threatened strike which immediately followed ultimately led to the withdrawal of Giolitti from the government. The most controversial government measure regarding strikes however was to come in with the substitution of Tedesco by Carlo Ferraris and the Ministry of Public works. The new measure coincided with government assumption of railroad management - which was conceived as the only effective means of eliminating the endemic class war in this sector - and proposed that under the law slow downs or strikes would be regarded as automatic resignation by the participants.

In July 1907 the anti-strike law was brought into effect, and a two day work stoppage was called for the 13th and 14th of October, which involved almost seven thousand workers, primarily in the Milan-Turin-Genova triangle. The Ferraris law would have its first application in the case of this strike which Lanino declared to be the "first political strike of a new series of railroad stoppages." [25] Sixteen workers were fired outright, 115 were

demoted, 650 had their pay suspended for two years, 5,706 would have to wait a year for a possible pay rise, and 242 workers were suspended for twelve or six days without pay. Workers' representatives asked for an amnesty for the strikers, a request rejected by the rail administration, and the bitterness between the two parties came to a head in 1913 with the formation of the Istituto della Rappresentanza - commonly known as the "Parlamentino Ferroviario" - to represent rail workers.

There was however relative tranquility on the railroads between the implementation of the Ferraris legislation and the formation of the "Parlamentino Ferroviario," not the least important reason for which was that during this period the railroads had essentially been brought under a form of military control. A complete series of measures was concluded between the Ministry of War and the railroad administration,

> under the direct patronage of the president of the Council of Ministers, Giolitti. This was done not only to reinforce the military engineering units specialized in the operation of the rails, but also to keep, in the largest measure possible, military personnel in continuous and active contact with the rail service, and have them participate directly in the operation of the network alongside civilian personnel...Moreover, training was extended to non-engineering military personnel, particularly as regarded station services and car manoeuvring, which involved organizing special courses for soldiers in the principle rail centres. [26]

As a disciplinary measure in itself, Lanino found this initiative highly laudable, commenting that "faced with the firmness of the administration, any foolish aspiration of opposition or resistance vanished very quickly." [27]

Despite the presence of the military, however, industrial action soon returned to the railroads. At the beginning of April 1914 an "economic" strike threatened, and the adminstration responded by issuing a circular to management of the line divisions, giving precise instructions and special powers to hire new personnel in case of a stoppage. The rail workers, Lanino wrote, were reminded of the Ferraris legislation of 1907, and "no amnesty had intervened to dimish the effect of the memory", and for the

moment the strike was called off.

In Ancona two months later however, for "political reasons" - the killing of some demonstrators - a strike was organized, which spread initial to Bologna, then throughout the peninsula, with the single exception of Reggio Calabria. This strike "even manifested revolutionary tendencies," and at its termination on June 13th the law of 1907 was called into force fo the second time. Forty-eight workers lost their jobs, 378 were demoted, 1,949 were denied a pay rise for two years and over fifteen thousand employees suffered the same penalty for either one year or six months. Over one thousand workers were suspended for a total of 12,603 days. [28]

With this strike and the application of the law, there was a "decisive change" in the relationship between the government and the adminstration of the railroads, as well as a change in policy with regard to personnel and workers. According to Lanino, until this point, although the state had assumed control over the Italian network in 1905, the railroad administratio in essence operated as an autonomous entity, not subject to "parliamentary interference". The end of the 1914 strike coincided with the appointment of Ciufelli as minister in place of his predessessor Luzzatti, and "what had only run the danger of compromise in 1911 under Luzzatti, was now definitively, and in full infraction of the law, accomplished by the honourable Ciufelli..." [29] With Ciufelli's intervention, the principle of apolitical and internal representation between rail workers and management "was damaged forever." The government was brought into direct contact with workers' organizations over industrial disputes, and in Lanino's view this move was responsible for all subsequent disruptions and industrial action in the rail service. [30]

At this point, the war "fortunately" intervened and temporarily delayed the "explosive" consequences of Ciufelli's interference. [31] The war, however coincided with an act "of particular gravity regarding railroad personnel":

a general amnesty was granted to workers who had been the targets of the Ferraris legislation of 1907, which, it appeared, was "an act of pacification in that grave moment for the country." [32]

One of the most serious problems in Lanino's view - during the war as a whole but in particular because of the amnesty for previously penalized workers - was that railroad management no longer had precisely defined authority and responsibilities in the event of work stoppages, and managerial staff did not know to which degree they could count on government support if disciplinary action was taken against striking personnel. Lanino himself visited the managing director of the railroads, R. de Cornè, to ask for a guarantee that the law of 1907 would be used in case of disruptions in the service. The guarantee was given, but almost immediately afterwards an even more "obsequious" minister of Transport was appointed, De Vito, who, through political intervention, effectively dismantled any structure of authority that remained in the railroad system.

More generally, Lanino insisted, political management of the railroads during the war - through the secretary of state for this sector, who presided over mixed committees of managers and delegates - and the compromises which emerged between the administration and rail personnel, allowed the more extremist elements amongst workers' representatives to increase in strength, and "legitimate representatives of personnel were moved into the sidelines." [33] For Lanino, this was made particularly evident in the debate over the eight hour day, an issue on which he felt the delegates of the secretary of state for the rails had been walked over by the socialist workers' representatives. A potentially explosive question, the workers' Sindacato won over the administration in having travel time in particular recognized as part of the eight hour working day.

Apart from its consequences in the slackening of discipline and authorit political management was also viewed as simply inefficient, which only furthe weakened management credibility in the eyes of workers. Lanino quoted the

report of a collegue in the railroad's management:

> Last summer a committee of workers came to me asking about a certain variant to the disposition regarding the eight hour schedule. After having replied that nothing had come down from our Division on the matter, the most eloquent and sarcastic of the workers spoke up, saying that the new reform had already been communicated to them directly by the Union a week earlier, and if the division boss wasn't aware of it, or if he knew about it and didn't tell them, it was a sign that he took no interest in the affairs of his own workers. [34]

For the workers to be better informed about regulations and legislative measures concerning industrial relations was, for Lanino, humiliating testimony to organizational chaos in the transport ministry, and a direct result of political management of an industrial operation.

Even before the war's end, Lanino had already begun to agitate for reconstruction of the political order through the transformation of political institutions into economic bureaux run by technicians. Writing in Ingegneria Italiana in July 1918, and in specific reference to the removal from office of General Dallolio at the arms ministry, and Riccardo Bianchi from the Director's job at the railways, Lanino wrote:

> Failure of the experts? We don't think so. But it is certainly the failure of the methods and systems that still make it impossible for the advent of technicians and "competenti" to the government of the country.
>
> In contemplating a superb whale run aground on a beach, we would certainly not say that this marvelous organism...wasn't fit for swimming. Rather we would think about the hidden dangers in the troubled and perilous waters nearby. By the same token, is seeing the efforts of two talented technicians - General Dallolio and Bianchi - smashed on the cliffs of the bureaucratic organization of our ministries, we do not criticize the great merits of the two eminent men...we are only reminded of how urgent is the need to orient the country towards government by "competenti".
>
> The time of the experts is just dawning. It is the century of politics that is setting. [35]

Lanino's critique of political control and industrial mismanagement of the railroads was combined with a more general demand for the liberation of all industrial activity from political interference, which in January 1919 was a process still underway:

> Produce! produce! (we hear), and in the meantime both imports and exports are blocked because of military controls. The railroads

> are in crisis, and the postal, telegraph and telephone system has been turned upside down...In America they have already seen to returning the rails to private hands... [36]

Special wrath however was reserved for the minister of Transport, whose compromising behavior with the rail unions ironically had the effect of intensifying militancy amongst workers. Immediately upon taking office, De Vito "begged" rail commissioner de Cornè to cancel previous fines levied against striking workers, a "prayer",Lanino wrote, that was naturally granted.[37] To even further emasculate his authority before the unions, De Vito had a circular distributed to rail workers, thanking them for their sense of duty in rendering services to the country during wartime. The eloquence of Lanino's outrage mounted:

> With this circular, the government's conduct...degenerated into the grotesque, in as much as the content (of the message) is nothing more than disguised weakness under the pompous affectation of authority...and in which the strident contrast between form and substance makes even more obvious the absence of dignity. [38]

By July 1919 the question of the 1907 law was again raised, because of workers' absenteeism, which, though not widespread, was "political": "None of them were punished, so great was the minister's indulgence," which was also to be the response in the first instance of an "attempted" strike at the same time. In light of the government's passivity, Lanino lamented, any worker could simply not turn up for work, calling his absence a strike if he so wished, and he could be confident that no punitive action would be taken against him. Starting from this period, and carrying on through the following year, there was "a profound and rapid change in the spirit of our railroad personnel." [39]

To fully understand this "change in spirit", it was important to look at internal relations in the railway labour movement, as well as the political relationship between De Vito's ministry and workers' representatives. Workers in the Italian railways were organized into two separate organization the "sindacato" as such, with its base in the engine and train personnel; and

the "movimentisti", who were mainly station bosses and officials. Due to day to day authority relations on the job, the two groups were rarely in agreement, the "movimentisti" seldom participating or taking a merely passive part in work stoppages, and traditionally "the dissent between the two organizations...had therefore always been one of the major reasons for the failure of strikes in the past." [40]

This situation began to change, to the obvious detriment of the administration, under De Vito's predessor at the transport ministry, De Nava, particularly over the early post war question of the eight hour day. In Lanino's view, which is the one that concerns us here, it was precisely the weakness shown by the political authorities on this issue which encouraged moderate station employees to side with the more radical train workers in subsequent industrial action. [41] Despite fears of union collaboration, however, solidarity between the two groups was short lived, and many"movimentisti", though not all, broke with the Sindacato over the question of the "political" strike of July 1919. The period which prefaced this stoppage, from January to July, was for Lanino characterized by a "veritable islamic fatalism" on the part of the government, while the Sindacato continued to strengthen itself, even garnering the support of some engineers, office staff and managerial personnel. [42]

With De Vito's appointment to the ministry in the summer of 1919, relations between the government and the Sindacato, by now the major vehicle of representation for train workers, dangerously worsened. The new minister called one of the old "movimentisti" into his cabinet, a man who had been one of the most fervent agitators in trying to keep the radicals of the Sindacato and his own union separate. The acerbity between the ministry and the Sindacato thus intensified, and the person of De Vito himself became the focus of class hostility on the part of train workers. In this context, any pretence that the railroad system was run as an industrial operation, independently of political interests, collapsed entirely:

> By now the minister had succeeded, in full violation of the law, in completely substituting his own individual personality for the management and administration of the railways. The strike that was ripening in this preparatory period thus assumed the character of a political struggle between the person of De Vito and the Sindacato. [43]

In the autumn of 1919 De vito was given yet "another opportunity to caus further grave damage to discipline". The increasing identification between the ministry and the railroad administration was symbolized in De Vito's electoral behavior (he ran in Teramo-Castellamare on the Adriatic), which included setting up his campaign office in a railroad car, and recruiting rail managers and administers as his electoral representatives. Contemptuous Lanino described De Vito's election fanfare in Castellamare, the minister himself breaking down into tears and kissing the local station boss: "By now the comedy had degenerated into farse." [44]

Apart from the disastrous consequences of the politicization of the rail administration in its relations with the Sindacato, De Vito's behavior also effectively demolished the managerial authority and autonomy of the administration, which Lanino emphasized, could only retain its credibility in the eyes of employees if it had the simple character of rational efficiency "Political" behavior, therefore, excluding by definition efficiency criteria in decision making, was also the antithesis of a credible expression of authority.

Such a malady in the exercise of authority was not only confined to the railroads, but characterized the parliamentary system as a whole. The anarchy disorder and verbal violence endemic in political control of the railways was reproduced in the chaos of the Chamber of Deputies itself: "a method of argument that unfortunately has been refined into a system in our parliament." [45] Most important in this regard was the workers' perception of such behavior, and Lanino reproduced the comment of a labour organizer for the railroad workers to illustrate: "if in parliament, which should be the palladium of a stable national consciousness, any disorder is allowed, even to the point of exchanging blows, why are we not equally permitted to strike?" [46]

In late January 1920 industrial action returned to the rails, and by the 23rd of the month all north-south traffic had been cut off, as well as a complete shut down in the Turin-Genova-Milan triangle. The new feature of this strike was the participation, in addition to the engine drivers and stokers, of large numbers of "movimentisti", and in Bologna in particular, some station staff and telegraph personnel joined in. The government's response was to issue a decree, stating that for the duration of the stoppage pay would be held back for all individuals involved, and demanded that all strikers return to work by the 27th. Lanino states that the government under Francesco Nitti gave the impression of having been taken by surprise by the strike, and because of "muddled moves" by Nitti the army was unauthorized and unable to intervene and force a return to work. The real heroes in what was for Lanino a national crime, were the members of his own corporate group, including some engineers who were not government employees, but who offered their services in trying to resolve the stoppage.

Despite political inertia however,"resistance began to organize to try and get the service operating again, and the effects began to be felt. In particular, this was thanks to the abnegation, spirit of initiative and sacrifice of our collegues in the engineering community." [47]

A group of Milanese industrialists, at the head of which was S. De Capitano - who was in charge of the government committee authorized to appropriate industrial property from Germany under the reparations agreements offered to mediate between strikers and the government, a move which Lanino regarded as a demonstration of profound weakness. In any case, the Sindacato rejected the offer, and the 27th of January deadline passed without any coercive action having been taken by the state. Given this inaction, the strike could only end by burning itself out, and Lanino contrasted the passivity of the Italian authorities with the decisevness of the Americans in dealing with labour militancy:

When punitive measures are not imposed, similar strikes can only be

> resolved by sheer exhaustion of both parties concerned. It is a type of trench warfare...By way of contrast, it is worth mentioning the response of American industrialists and businessmen who, through a boycott of the striking miners, acted as a decisive force in the victory of the country over the strikers. [48]

In Rome, strike leaders were called to Palazzo Braschi to negotiate, and Nitti himself, as well as the minister, was present. Despite De Vito's promise that non-striking stokers who had substituted for drivers during the dispute would be allowed to keep these jobs, one of the clauses of the Palazzo Braschi agreement was in fact that all strikers would be offered their previous jobs back. The Sindacato had threatened another work stoppage if De Vito's promise were kept, and the government had been forced to submit.

Most disturbing of all, however, was that "the enormous power of the unions...was deliberately concentrated against the principle of authority itself, and therefore against the individual person of the manager as the expression of authority." [49] More generally, the way in which negotiations were conducted revealed the central point of Lanino's polemic, a critical observation which underpinned his whole conception of social reform: "Unfortunately, this is the interlaced fabric of our entire political world, in which questions of interest, even the most legitimate, are listened to only if they assume a political form." [50]

Further "humiliation" followed with the Sindacato's success in having the military machinist trainees, placed by the government to act as a reserve force in the event of a work stoppage, withdrawn from the railroads. Moreover on the 8th of March a circular was issued by engine drivers, inviting "comrades to refuse to allow aboard their locomotives any unauthorized individual, excepting only engineers of the traction service, locomotive deposit bosses and overseers. [51] Permission to board the locomotives, therefore, was denied to maintenance engineers, who often had to travel in the locomotives. Though senior in the railroad hierarchy to the drivers, their authority would be unrecognized, and they would be blocked in the normal execution of their work.

By May 1920, the point at which Lanino's polemic came to a close, "one (had fallen) into a true libido of the strike". From the first of the month, Lanino wrote, for the first time there were signs of the total suspension of the Italian railroads. Even all the car deposit staff joined the strikers at this point. The worst aspect of all for the engineer was tha the repressive power of the administration was inversely proportional to the need for it:

> The railroad adminstration has been disarmed. not only of any repressive power, but also of any possibility of even hoping to keep the service in operation...not only does it no longer have "teeth to bite with", as Avanti! put it...but it no longer even has the trust of our engineering collegues in the rail system. [52]

For Lanino, the stoppage of May marked a break in strategy by railway workers. In this case, industrial action had not simply been taken to defend the interests of a particular group, but was part of a larger and explicitly stated strategy to overthrow the existing social order. Examples were cited to illustrate the workers' increasing sense of strength, nurtured by management's powerlessness: In Livorno a driver had detached his locomotive from the rest of the train outside of town, and had simply driven into the station without any cars: "When asked the reason, he simply said that he had 'come in for a pack of cigarettes'"; on the Rome-Naples line a driver abandoned his locomotive outright at the station of Segni, on the grounds that his eight hour shift had finished; on the Pisa-Viareggio line a train had been taken over completely by workers, to transport some comrades to the funeral at Viareggio for the victims of a fight over a football match. Moreover, train workers refused to transport war materials to be used against the Soviet Union, and they were forcing soldiers, carabinieri and militia men off the trains. [53] Again, the problem which concerned Lanino was not the validity of this or that point of view, nor the details of the grievances. His professional training and discipline recoiled most particularly at the mere fact of disorder, and the open challenge to the abstract principle of hierarchy and authority:

> These (incidents) were evidently planned in advance to subvert authority, and as a deliberate challenge...to railroad administrators. Managers have been left completely deprived of the power to act - indeed, they have been warned, both from above and below, against taking any authoritative action whatever. [54]

In contrast with the endemic disorder on the state rails, Lanino emphasized that the private companies running secondary lines were much more efficient in dealing with strikes, and their "apolitical management" was even manifest in the reform ideals of the workers in their employ, as expressed through their representative organization, the Confederazione del Lavoro (government railway workers belonged to the autonomous Sindacato). As Lanino remarked in Ingegneria Italiana, the only post war organizations which represented "real" social reform were the Partito Popolare Cattolico, the Socialists, and the Confederazione del Lavoro. [55] Being a corporate group rather than a political party, Lanino logically concentrated his commentary on the program of the Confederazione del Lavoro.

His first reportage on the question appeared in the January 1919 issue of Ingegneria Italiana, in the context of renewed strike activity on the rails, where point 4 of the Confederation's "war claims" was reproduced: "Transference of deliberative powers regarding technical aspects of laws and related legislation from Parliament to the appropriately transformed consultative syndical organizations." [56] The engineer was "in perfect agreement with the ideas and intentions" of the Confederation's plan for social reform, though in his view this was only a start. One problem with the Confederation's plan for electoral reform was that the allegiances and role of the engineering community were distinctly ambiguous. The Confederation had suggested that representatives of professional associations be nominated in electoral lists for each region, according to whether they belonged to the proletariat or an employers' group. Given his analysis of the situation on the railroads, Lanino could only respond ironically to the Confederation's proposal: "And to which class do the engineers belong? To the proletariat, evidently, and today more than ever!" [57]

Indeed, the political weakness and uncertainty of the engineer's social function was due primarily to the characteristics of the work he performed: he was victim of an excessive "technicism", and obsequiousness with regard to employers. On the first point, Lanino had already launched a critique even before the war's end:

> The engineer tends to be too much of a mere technician. When technology becomes technicism we have made an error somewhere... The technician tends to dissociate himself too much from administrative problems, which are then appropriated by the so-called administrators. In a technical organization, however, these people should be no more than the executive element in adminstrative work, under the managerial authority of engineers. [58]

In surveying an article written for the British Institution of Electrical Engineers by a Lt. Colonel O'Medra, Lanino argued that this "technicism" was a legacy of a time when the engineer was primarily a builder of bridges, canals, port facilities, and so on: structures that, once constructed, no longer required the engineer's attention. [59] Although the "war (had) demonstrated the importance of the engineer in industry and commerce," the precise social function of the technician, as the British officer pointed out and Lanino agreed with, remained "uncertain". Unlike the engineer of the past, the work of the modern engineer consisted in working with technologies and projects that demanded continual attention in the maintenance and substitution of plant and materials. A large part of such work was naturally technical, but there was also a multitude of

> commercial and adminstrative problems, concerning current prices, organization, personnel, control and management...Because dynamic laws are continually in operation when dealing with industrial technology, and because it is necessary to constantly substitute and expand capacity of machinery, the engineer can no longer entrust his work to unqualified personnel. [60]

Reform required education, and Lanino cited the laudable example of American technical education, in which business engineering sections had been set up in institutes of technology some time earlier.

Important work was also being carried out in France, Lanino revealed, largely through the efforts of "Enrico" Fayol, whose theory was considered

earlier in the thesis. Certainly one of the greatest obstacles in hinderir the formulation of a precise self-definition for the modern Engineer was th absence of a managerial doctrine, a methodological lacuna which Fayol's work finally appeared to fill. In the present context, if the development of the public administrative movement should be seen as a chapter in the history of political thought, [61] Fayol's work of 1916 must be regarded as the opening paragraph in the European story, particularly important perhaps in a clientelistic political society undergoing economic development such as Italy. Lanino's conclusion was that "however one judges the work of Fayol, he has certainly made a notable contribution to demonstrating the nee for a strong administrative education for the engineer." [62]

Supplementing engineering training with a stronger managerial and adminstrative component would be the mechanism by which the artificial barrier between political and technological work would be overcome. In emerging from their marginal technicist niche, however, engineers would have to be careful about defining their terms and strategy, and Lanino counselled caution: "It looks as if politics is becoming the fashion...even amongst engineers. However, it must be clarified precisely what is meant by the term." [63]

Making the political authorities more competent in dealing with the increasingly technical aspects of modern legislation was not, however, simpl a question of staffing the public administration and parliament with engineers. Compromise and vacillation was inherent in the political structures themselves, and merely substituting engineers for "lawyers" would not be adequate. [64]

Earlier, in August 1918, hope seemed to be on offer for reform work tha would unify administrative, executive and technical work in the organizatior of the public authorities, through the appointment of G. Villa, president of the Federation of Italian Engineers, to head a committee for the reform of the public adminstration. While at the Ministry of Transport Villa had

"affirmed the need to reinforce the technical capacity of the state administration, in view of the broader range of industrial activity that the government would have to assume after the war." [65] On the publication of the Villa commission report in early 1919 however Lanino's vision had again been defeated by half-way measures:

> We were finally hoping to see technical considerations given their due and necessary importance in the new political administration.. complete disappointment...When one says "technician" in the political administration, it is not understood to include administrative work - that is, "who gets things done" or "who produces" is meant, but not "who manages". This latter work is reserved only for the professional "politician-administrators." [66]

Conceptions such as the Villa plan - which envisioned the function of a reformed political administration as having limited responsibilities of economic monitoring, rather than actively deciding on economic and industrial issues - were "excessively formalistic", and indeed, it seemed that even an engineering vision of reform could be corrupted, or in any case utterly emasculated, by contact with the universe in which the "lawyer rules". [67]

A minimal first step in reform had been taken however with the formation of the new cabinet in July 1919, which included the engineers Dante Ferraris (and "expression of large scale Italian industry...in any case he is an engineer, and one thing complements the other." [68]); Cesare Nava to work in the liberated territories department; Anselmo Ciappi, who passed from the undersecretariat at the Ministry of Transport to Public Works; Sanjust di Teulada, a parliamentary representative from Sardegna, who was chief inspector of civil engineering at the transport ministry; and finally, Ettore Conti, who was undersecretary of state at the Ministry of the Treasury, charged with liquidating war time contracts. In the particular case of Conti, Lanino "would have preferred to see (him) invested with planning and constructive functions, rather then simply that of terminating military contracts." [69]

In September 1919 a radical new push was given to the construction of the engineers' social and political identity, by the strikes in Turin's metalworking factories. For Pietro Lanino, one feature of the Italian engineer's mentality revealed during this period - which, apart from his narrow "technicism" served to block his entrance into higher level manageria administrative and political work - was his "servility" towards employers. 7(Reforming engineers interpreted the strikes of the summer and autumn of 1919 as testimony to the bankruptcy of this relationship, in which the mediating potential of engineers was underutilized, and brought to light the need to expand the responsibilities of technical personnel in capital-labour disputes In essence, the problem of class struggle was perceived as a problem of making authority rational, which logically could only be realized by allowing a larger presence for the engineer in his natural role "between the hammer and the anvil". To simply declare, "I am in command and you will obey" was no longer adequate to ensure discipline and stable authority in the workplace. This simplistic and paternalistic style of managerial behavior had become obsolete in the new industrial economy, which demanded legitimacy in authority relations. The manager who degenerated into "servility" toward the employer, who "only sees the material interest of the employer", not only damaged relations with workers but could also be acting against the higher interests of the firm itself. As Fayol had insisted upon earlier, th problem of legitimizing authority was the problem of rationalizing management, and in this instance for Lanino employers attitudes and the timidity of engineers were largely responsible for violent class struggle in Italian industry. [71]

Intensified industrial action and factory occupations by metalworkers in September 1920 further fueled the search for occupational self-definition this time under threat of a movement that undermined the most basic cannons of the engineers' procedure of order through hierarchy: workers' control.

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Intensified industrial action and factory occupations by metalworkers in September 1920 further fueled the search for occupational self-definition this time under threat of a movement that undermined the most basic cannons of the engineers' procedure of order through hierarchy: workers' control.

Again, the challenge to discipline proved decisive:

> Workers' control, as exercised by the shop councils, already represents a grave challenge to discipline. And the first to feel the troubles will be the engineers. At the same time, the (workers' control movement) constitutes a dangerous threat to the interests of industry itself...The first things to be sacrificed would be new investments and technical improvements, without which an industry cannot survive...We believe that workers' control, whatever the system of industrial organization, is lethal to industrial production...Private property is no longer respected, nor even individual freedom. [72]

Resolution of the question of the role of engineers in social management was no longer academic debate: a fatal challenge had been posed, and action had to be taken immediately:

> In this first clash, as usual the engineers were among the first in the middle of it. We have seen acts of personal violence, some people suffering quite serious attacks, and others victimized by unlawful restraint...Practically material for the American cinema!...To place the engineer in this picture of conflict between employers and metal workers, it would be useful to draw attention to questions that have been discussed often and thorough by this journal: that is, the position that the engineer must clearly assume as the third element between capital and labour, distinct from but equally necessary to both parties.
>
> The final question remains specifically the moral and material treatment of engineers by industrial employers. This is a problem which has never been adequately resolved - now would be the time to deal with it. [73]

The October 1920 meeting of the Confederazione Italiana del Lavoro Intellettuale could have been used as a national platform from which to state the engineers' case, Lanino wrote, but in fact the turnout was yet another disappointment. Of the various engineering associations in existence across the country, only the "ingegneri combattenti" of Milan were present to represent the corporate group, and members of the Collegio-Sindacato nazionale degli ingegneri italiani. The participation of the nation-wide Associazione nazionale degli ingegneri italiani, the largest single organization of engineering associations in the peninsula, was conspicuously absent. [74]

Soon however the challenge to order, hierarchy and authority that was explicit in the workers' control movement compelled a reaction from engineers, and the issue finally formed part of the discussions of the firs

National Congress of Italian Engineers in Rome in December, 1920. For once, Lanino could comment favourably on the "civic conscience" of his profession: "The engineer is beginning to understand that he can no longer and must not, out of his duty as a citizen - keep himself isolated from the world and the rest of humanity, as the great majority of them have done unti today." [75]

In an immediate context of massive and continuous strikes, particularly in the railroad and metalworking sectors, the engineering ideology most succinctly and lucidly expressed by Pietro Lanino and Ingegneria Italiana began increasingly to capture the attention of the engineering community as a whole, and formed part of an evolving reform discourse emerging at the margins of political society as well. As the early fascist movement would keenly perceive and exploit, it was the struggle for order which was the revolutionary element of the time, the historical moment having arrived when growth and expansion in the means of production presupposed a fixed and undisputed structure of functional authority in the uncertain universe of social relations. Particularly sensitive to this paradoxical identity in the modern social order, the engineers found their contribution in the vision of administering change in the technology of production, while ensuring stasis in the social relations on which technological progress depended. They could therefore not fail to find solidarity in a political voice which strategically identified itself wholly with the concept of order and the inviolability of the value of functional authority.

Paralleling the contemporary concerns of the engineering community, Giuseppe Bottai explained in 1924 that justice was a luxury of stable and already disciplined societies. The real revolutionary strategy for Italy at the specific historical moment of the immediate post war years would be the establishment, or the imposition, of order. Fascism therefore fashioned an image for itself as the porter of the twentieth century revolution of

"change without movement":

> There was a crisis in Italian life that the victory of fascism has resolved: the crisis of authority. The struggle against fascism is the struggle against authority. [76]

This would be however a new kind of authority, one which, being based on a rational allocation of power among functional hierarchies, would give rise to its opposite: from stasis and the containment of change would emerge the conditions for creating a permanent dynamic in the economy and in society. Given such a form of self-identity in the early 1920s, it is perhaps hardly surprising that among the first professional associations adhering to the fascist consigli tecnici - which were to contain all the managerial expertise available from the world of technology and industry but without the presence of the employers' organizations - were Pietro Lanino's National Union of Italian Railway Engineers and the National Association of Italian Engineers and Architects. [77]

Authority was to become rational, and would therefore be structurally impeded from serving "speculative" and socially fragmentary ends. The organization of authority, power and decision making in society would itself determine a social and economic dynamic which would inherently preclude the pursual of irrational goals, and the disinterested mediation of the "third element" working in the consigli tecnici would guarantee that this was the case.

The roots of political fantasy are however generally fixed in very humble ground that, in one way or another, is connected with the exploitation and allocation of disputed resources in society. The corporatist vision propogated by engineers in the years after world war I was not an exception, and this paper has tried to suggest some of the more long term historical reasons for the emergence of such a vision in italy, as well as looking into some of the more immediate catalytic events which helped to piece it together and give the ideal coherence. The two final sections to follow will consider the expression of this ideal in a broader sample of

contemporary engineering literature, and the diffusion of an engineering vision of change in the bureaucratic apparatus of the state itself.

Engineers and the Politics of Order

By early 1919 the reform ideology expressed by men such as Pietro Lanino was increasingly making its mark on the reform landscape, and the "third element" saw it as their moment.

In and October 1919 article in Lanino's journal, the engineer Felice Corini tried to confront some of the more pressing practical problems of getting engineers into politics. Being a corporate group on a national scale, Corini explained, engineers had lost a good deal of strength as an organized class because of a new electoral law which was based on provincial political units. [1] Given the fact, therefore, that engineers could not act directly as a class to have their representatives elected to parliament, it would be necessary to examine "how engineering organizations could be reconciled with the various existing parties." [2] Corini advised caution however, emphasizing that the engineering associations "must not identify themselves too closely with any particular party...they must unite to defend the class (of engineers) and to affirm the culture of technology." [3]

As an ideal means of realizing this unification, Corini suggested that the National Federation of Engineers could promote agreements between the various locally based technical associations. In the absence of coordination on a national scale, the local organizations could select figures to represent the class as a whole, "independently of the political ideas of individuals", and the association of which the nominee was a member would arrange with various national political parties to have their engineer representatives presented as electoral candidates. Fulfilling such a scheme would require insertion of a clause in the electoral regulations regarding minimum support needed for nomination of a candidate "that gives special value to the appointments made by economic and cultural associations." [4] In this way, engineers could enter directly into the political life of every constituency, representing perhaps a range of political groupings, but overall acting in the interests of national economic efficiency and protecting the interests of their corporate group. [5]

An additional problem for engineers entering politics would be a legal one, rooted in the weak technical base of Italian industry itself: in 1919 the largest employer of engineers was still the state administration, and public servants were legally barred from running for political office. Corini's concern being to have political positions filled immediately by qualified technicians, he urged that this question would also have to be confronted at a legislative level. [6]

A sense of international solidarity within the engineering community was also an important stimulus in the diffusion of the corporatist/technocratic vision, and from Germany - together with the United States the maximum representative for Italian reformers of economic and industrial efficiency - the ideas of Walther Rathenau had crossed the Alps, with Belluzzo's journal Industria making critical comment. Rathenau's wide-ranging program for reform and reconstruction had proposed organizing all industries into compulsory syndicates, grouped together according to sector and function. Each firm would send its manufacturers to the syndicate, which would set prices. Through the syndicates standards would be fixed for the sector as a whole, and luxury items would be specially classified and a special tax would be levied on them. Middlemen would be eliminated by use of the commercial organizations of the syndicates themselves, and scientific management would be generalized throughout the entire industrial system. the structure of industrial organization itself would be an inherent block on speculation, and only large-scale producers would participate in the manufacture of all industrial commodities.[7]

The sheer ambitiousness of the plan drew restrained comment from the Italian commentator, but in the Italian context the implicit "anti-politicism" of Rathenau's industrial utopia demanded consideration:

> Just as the potent military organization that (Rathenau) conceived and translated into practice did not help to win the war, so one would hope that his project of industrial organization

> for post war Germany does not serve to renew the competitive strength of German products on our market...There is however undoubtedly something in this plan that can be applied here in Italy, and in fact that is already being applied. [8]

The obvious implications that some form of "syndical parliament" held for final recognition of the social value of the engineering community began, in 1918 and 1919, to occupy an increasingly large part of the technologists' self-definition. In a speech to the Italian Electrical Engineering Association in June 1919, the engineer S. Passer urged upon his collegues a more active intervention in the social changes underway:

> Nobody foresaw that post war events would happen as they have done...In Italy, preparatory work (of reconstruction) never went beyond statements of principle, without precisely indicating how they were to be applied. [9]

Moreover, in the context of the unforeseen chaos of post war society, "the old world simply re-stated the usual rhetoric: particularist interests aroused themselves once again..." [10] In the competitive world of post war capitalist struggle, such parliamentary indulgences, combined with rising labour costs and industrial work stoppages, could simply not be afforded. In the meantime however, the state continued to function merely as a forum for the resolution of economic problems by competing interest groups and associations:

> In this context, it is impossible to remain inert or absorbed only in the examination of exclusively technical problems... beyond party political interests, we will be able, more than any other profession, to look at social and political problems with a greater sense of opportunity and detachment... [11]

Specifically, Passer, suggested, the electrical engineering association could intervene in the legislative question of concessions for hydro-electri power development. This would include the formulation of tariff policy and determining criteria for the distribution of concessions. In addition, the engineering community could contribute to the effort to emancipate Italy from foreign economic dominance, by forming special committees to control

imports and develop programs for the exploitation of indigenous resources. An important intervention would also be the direct participation of the electrical engineering association in the conception and execution of an overall plan for the electrification of the railways. More generally, given the economic significance of the newly evolving electrical technologies the engineers of this sector would have to form a larger presence in all state offices concerned with economic matters, as well as having a considerable enlarged policy vote in the local Chambers of Commerce, provincial and comunal administrations, and finally in parliament itself. The internation- economics of post war science base capitalism presented no other alternatives "We must change completely our industrial structure, becoming producers instead of consumers." [12]

Not the least important consequence of such a transformation in the structure of industrial organization, as L'industria's contributor Francesco Magri emphasized, would be social peace. [13] Although everyone had nothing but praise for the British system of trade unions, Magri observed, it was too seldom stressed that the successful capital-labour collaboration achieved in British industry had evolved hand in hand with industrial and economic development. [14] For Magri, the new orientation of workers' organizations was

> the most important fact of the industrial and economic life of the nation. When the entire workers' movement has undergone this definitive transformation in every country, labour conflicts will be regulated almost automatically. [15]

Both industrialists and workers would have to cast off the illusion of autonomy, and realize that each was nothing without the other. Having liberated themselves from such problems, industrials could then turn their attention to their true function of examining the questions of raw materials acquisition and synthesis, technical innovations, diversifying their product and so on. In the meantime, Magri commented, some real progress had been made in industrial relations in Italy, particularly regarding questions of health insurance and various forms of industrial legislation, and "even

the most idiotic of proletarians" could no longer make a blanket denunciatio of the obscurantism and backwardness of Italian industrial employers.[16]

Later in the year, in November 1919, the question of the role of engineers in political management was raised at the engineers' conference in Florence. In his inauguration speech, the conference organizer Leone Poggi declared that

> the problems which will emerge will be such that one can no longer assume that lawyers can continue...to run the department of public works, or that incompetent deputies can legislate on technical and industrial questions. Moreover, it is unacceptable that engineers and scientists are still absent from parliamentary commissions formed to examine laws concerning industrial reform... The engineers must prevail, and parliament will have to be reforme to represent class syndicates as well as merely representing political parties.[17]

At the same conference, the president of the Tuscan College of Engineer and Architects, Guido Toia, approached the problem from a philosophical supposition which had as its base the standard procedures in the conception and execution of engineering work:

> Organization is the indispensable element of collective strength, and the secret of its bearing practical fruit lies in the goal to which (the interdependent action of its components) is directed - a goal that must be very clearly and precisely defined.[18]

In the everyday work of industrial production, and the consequent politics of capital-labour relations emerging from it, the job of specifying goals and organizing the relevant factors in conformity with the desired aims, could only be the responsibility of those whose professional training proved adequate to the job at hand: "The engineers, the necessary connecting elements between workers and employers, have become the essential elements of production and the producers of the nation's wealth."[19] As their spokesmen, Toia continued, workers were almost always represented by lawyers whose legalistic approach was by definition combattive and antagonistic. Instead, and in the name of efficiency and stability in economic and political affairs, the "guardians" of workers interests, when they were not workers themselves, should be engineers.[20]

All was a question of the efficiency of management at the production level, and the consequent rationality or illegitimacy of authority in the society as a whole. In the wake of the strikes by metalworkers in Turin, this reform notion, which formed a natural part of the intellectual baggage of engineers, was given its final decisive push as political ideology:

> For there to be progress in the world, there must be those who command and those who obey. Just as until now only intelligence and knowlege have guided and led human affairs, so the pretension of workers to overthrow the existing social order was absurd... Those who have been conditioned to obey...would have risen to command positions...The more we study the phenomena that have accompanied this tormented and unsettled post war period, the more we are convinced that they are the fruit of a vast ignorance prevailing in the population, both amongst the proletariat and in some groups of the so-called bourgeoisie. For the proletariat, ignorance is intended as it is commonly understood; for the bourgeoisie, it is meant as an incapacity to appreciate the changes required for the the post war period, and the new social conditions which cannot permit speculation and the waste of resources... Convinced that the waves of disruption can be placated only when ignorance is eliminated, our industrialists are organizing a vast project of educating workers. Employers in the engineering industries in Milan are furnishing the first example. Following the establishment of the workers' schools, we would hope that Italian industrialists, reunited in a powerful block, will be able to give us a government as well. [21]

In March 1920, Confindustria president Giovanni Silvestri made a similar invocation. In such grave conditions for Italian industry, Silvestri commented, there was "too much fatalistic apathy on the part of the Italian bourgeoisie." [22] This was particularly evident as regarded "political conditions". The government did not seem to be aware of how dangerous the situation was for industry, and the bourgeoisie, "blind to its duties, proceeds light-heartedly, unthinkingly and almost drunk with the speed at which we are moving towards the abyss." Workers were only concerned about political victory, not the economics of the situation, and the government had made no effort to put a stop to the disturbances. Where the bourgeoisie had failed, the state must intervene. Silvestri cited the socialist journal Avanti!, and agreed with their position that given the bankruptcy of the bourgeoisie, there remained only two choices open to Italy: reaction or communism:

> The country can be saved, but the productive classes, and most importantly industrial employers, must close ranks. We must join forces and oppose with all our strength those who - under the guise of economic reason but in fact having only political motives - try to overthrow the social, political and economic order which is the basis of modern society. [23]

From the industrialists' standpoint, "political" interference in economic affairs was identified as one of the roots of the problem. Looking back on the problem of excess expansion, often in obsolescent technologies, and the subsequent overcapacity crisis in the post war period, Federico Jarach - president of the Fascist National Federation of Engineering and Metallurgical Industries - cast blame on the industrial policy of the Italian state. [24] First, Jarach argued, the government pushed industry to expand plant, promising immunity from tax on the liquid assests earned. Later, this legislation was changed (by Giolitti's brief post war government) and many industrialists preferred to transform their circulating capital into fixed assets of every type, which would protect them from the "rapacity of the tax service". [25] Moreover, prior to fascism "chaos" ruled in the relations between government and industry, because of the lack of planning in the way state orders were made for industrial manufacturers:

> Almost never did these orders correspond to the normal rhythym of maintenance and substitution in the production cycle. Rather the dominant criteria was the greater or lesser availability of funds in the budget. [26]

Large orders would be dispatched at irregular intervals, which rendered the entire industrial structure particularly sensitive to demand crises and overcapacity problems. "Politics" in the new economic environment would have to be restricted to the maintenance of social order, and the "withdrawa of the state from economic activity could only mean tax concessions and a fiscal policy which imposed no burdens of social responsibility on private capital.

Where industrial employers increasingly invoked coercive state intervention to fill the void left by the "failed" bourgeois revolution, engineers continued to devise schemes to rationalize the economic structure,

and thus provide a rational base for authority relations in Italian society. The more engineers clashed against the system which had created them, the more they fled into a productivist ethic and "technocratic myth-making", which only served to further highlight the contradictions their reform values were designed to resolve.

At the June 1920 national conference of engineers in Naples, even the socialist engineer Romita's motion to have the phrase "class struggle" used to describe the corporate interventions of the profession was rejected, on the grounds that this would automatically associate engineers with the socialist movement. [27] Pietro Lanino commented that the fact that the engineer was a salaried employee tends to pull him towards the status of a worker but, on the other hand - and because of his managerial functions in the production process and, more generally, his bourgeois social background - the engineer more often than not tended to align himself with capital. [28] Nonetheless the language and the concept of class had entered the engineers' vocabulary, though intended in an exclusivist and corporatist sense to define the separate status and function of engineers: "we still believe that the engineer can and must maintain his individuality.. the corps of Italian engineers must increasingly assume...the nature of a class." [29] It continued to be the managerial problem in modern industry and politics that demanded the presence of engineers, and in this regard Ingegneria Italiana could favourably cite the view of the union organizer Colombino, expressed at a congress of the Federazione Italiana degli operai metallurgici (FIOM) in Genova in 1920:

> The technology of production in workshops is relatively simple, if by that is meant the distribution, regularization and study of individual operations. Specialists in these areas are not lacking and will not be lacking in the future. Instead, the techniques of general administration, the total management of the firm, is a much more complex and difficult question. [30]

Indeed, the engineers' critique was integrally related to the lament that scientific management played only a minimal role in the organization of Italian industry at the shop level. Earlier, in November 1918, Lanino

had already pointed out that Taylorism had provoked only academic interest amongst Italian industrialists, and the diffusion and application of scientific management would have to be the first step in the multi-layered process of constructing the new social order. [31] Italian industrial employers had not however done their part in assisting the process of reorganization for the future, "in which it will no longer be enough merely to produce at all costs, but it will be necessary to produce economically." An exception to the silence hanging over Taylor's name was an article that had recently appeared in Avanti!, which however had been totally hostile to scienfific management. "However," Lanino rebutted, "one cannot speak of exploitation when the name of Taylor is called to mind." [33]

This managerial obscurantism on the part of Italian employers and socia critics had to be contrasted with the more friendly reception given to scientific management in French industrial and even political circles. [34] The reformist work of Henri Le Chatelier and De Freminville was beginning to show results, and in particular a recent series of lectures by the American management consultant and engineer Bertrand Thompson at the Conservatoire des Arts were having a concrete effect. Following the lecture Alexandre Millerand - ex-minister of state and president of the board of directors of the conservatoire - announced that the French government had decided to employ Thompson as a special consultant at the Ministry of Armaments to analyze and reorganize production in the government arsenals. [35] The substance of the Thompson lectures had already been reported in the November issue of the technical journal edited by Lanino - Rivista Tecnica delle Ferrovie Italiane - and the comment in Ingegneria Italiana was intended rather "to push Italian engineers into studying the vital questions posed by scientific management, to eliminate prejudices and show what has been done abroad...in preparing for the industrial competition of tomorrow." [36] In acquiring such skills, however, Lanino warned his collegues against losin signt of their proper role as mediators:

> There is no reason why the engineer...should continue to ally himself with the industrial proprietor...Equally...there is no reason why he should pass to the other side, together with the workers...the engineer is the figure in the middle. 37

By October 1922, it appeared that the political basis for the efficiency vision was finally and for the first time being firmly laid down. "The political life of the nation," L'Elettrotecnica wrote, summarizing the views of the engineer and economic and political editorialist for the same journal Domenico Civita,

> has been afflicted by unjustifiable parliamentary crises, and by another attempt at a general strike. This heedless strike provoked a counter-offensive by the fascist movement, which has succeeded in suffocating the socialist effort. Yet again fascism has assumed the political initiative, carrying out what should have been the task of the government.
>
> Abroad they are beginning to view the fascist movement as a new phenomenon and worthy of closer study...The Italian people have spontaneously rejected the bolshevik offensive which threatened to suffocate the country two years ago. It is to be hoped that fascism will not commit the mistake of abusing the position it has conquered.
>
> In essence, our country is healthy and anxious to flourish again. With a bit of courage on the part of the government, a little more technicism and a bit less politics, we will also be able to resume economic and industrial activity. The United States and England have already started on the road of industrial reconstruction, and France is beginning to show positive signs of it as well. 38

The question of foreign approval of early fascist initiatives to "order" society in preparation for its economic and technical rationalization was a theme repeated by Civita some months later:

> It is clear that in America people are starting to look to our country with genuine interest. The conviction is beginning to form that Italy has really set itself on the right road. 39

The imposition of authority was however combined with a strategy of change which would ensure that the stability necessary to growth would not be transitory. Referring to a meeting of December 1923 between Mussolini and the major exponents of large scale industry on problems relating to the metallurgical sector, Civita commented:

> The government continues to show a clear interest in technical matters, most particularly by their actively seeking out the

> collaboration of the "competenti"...in a meeting with representatives of the fascist "gruppi di competenza", the honourable Mussolini repeated a theme, discussed many times before, of the eventual constitution of a type of technical parliament. [40]

This reformed parliament, as Civita was pleased to point out, would have legislative as well as merely consultative functions.

Speaking specifically for the electrical industry with which he was directly connected, Civita had earlier taken his stand with Pietro Lanino, foreign collegues such as Fayol, and most of the reformist engineering community as a whole, on the issue of the threatening nationalization of this sector, a position which the early fascist movement would be quick to perceive and support. [41] Such a move

> would remove one of the few sources of pride that Italy possesses: the development of the electrical industry. The distribution of electrical energy - which is and must be in the future the basis of our entire industrial structure - would atrophy fatally, just as the railways, telephones and almost all state controlled sectors are decaying. [42]

The rising star of Giuseppe Belluzzo expressed similar enthusiasm within six months of the fascist seizure of power:

> All our industrialists must be allowed to carry out the improvements that they have been unable to effect, neither during the war for obvious reasons, nor in the post war period because they have been kept busy simply trying to defend themselves - on the one hand, by continuous assaults by the revenue service, on the other by the impetuous demagogy (of workers) which more or less affected everyone.
>
> Thanks to the fascist government, the order and calm that now prevails in Italy will give the industrialists the opportunity to realize, even with some sacrifice, all the technical and economic reforms necessary in an atmosphere of tranquility.
>
> We hope that the new government, animated by the best intentions and determined to maintain the pretige of Italy abroad, will continue to work to satisfy the needs and requirement of the new times. [43]

For engineers therefore, suffering the battering insult of the workers' control movement, the initial moves of the fascist government to establish order by coercion and withdraw from economic intervention were part of the integrated policy package which promised social peace and a dynamic industrial structure.

Writing in early 1923, Domenico Civita praised the new government's decision to reform the National Insurance Institute, by dissolving the board of directors - which had been too much subject to "political" influence - and replacing it with a Commissioner to act as a mediating figure between private and public interests. [44] At the same the government was working on streamlining the public administration by getting rid of redundant positions in the civil service, as well as constituting a new militia, "which can only have very favourable repercussions for complete domestic pacification." [45] In general, the situation seemed auspicious indeed for the triumph of a rational vision of authority, stability, growth and innovation in the new corporate order; and, at an international level, Italy appeared to be establishing itself as a model for others to follow:

> In consoling contrast with the political situation abroad, we have the domestic situation of our own nation. There is an undeniable general sense of security prevailing, and one has the impression that a capable man is at the helm. From this we have emerging a desire for discipline which derives from trust. From the moment the new government rose to power, there has not even been an attempt at a strike. [46]

Because of fascist intervention, Belluzzo pointed out in 1923, only 200,000 work days had been lost in 1922, as compared with the staggering figure of 7,000,000 work days having been lost through strikes the year before. [47] Belluzzo observed that until the fascist assumption of power, the one raw material that Italy possesses - human beings - had not been properly exploited, and "Mussolinismo" - by which was meant both an affinity for social order and a technical dynamism - had indeed become a profoundly rooted sentiment in the population. [48] By late 1923, Belluzzo's optimism for economic growth and social stability in the peninsula was uncontainable:

> Today Italy pulsates with a new fervor in the fields of scientific research and production...If some centuries ago the Renaissance was defined by immortal works of art, today it is affirmed and immortalized with works of science and technology. in the work of conceptualization and creation (of the new technological society) the government of Mussolini is the dynamic element and the initiator. [49]

Moreover, besides those who honoured fascism with mere words, there was a large body of scholars and researchers who intended to pay respect to the new political movement with practical work, "because they are electrified by the efficiency and dynamism of the leader of the government, and because they feel that in today's world fascism means rebirth." [50]

More concretely, and at an institutional level, fascism had taken steps to liberate industry from the constraints of old laws which had restricted the free movement of manufactured goods within the country. [51] Among the most important of these dated back to the unification of the Italy, and concerned "the very grave and anti-economical tributary charges levied by comunes on the free internal movement of commodities." [52] On the 24th of September, 1923 legislative measures were taken by the Ministry of Finance to rectify this problem. As a result of pressure applied by the Industrial Federation of Lombardy, local comunes were legally empowered to levy tariffs only on a restricted number of products specified by the Ministry, acting on behalf of the employers' federation, and this was limited only to the comunes suffering a particularly serious trade deficit or budgetary crisis. Application to apply tariffs had to be renewed every year, and a maximum limit of five years was placed on the renewal of application. Furthermore, a limit of a 25% increase over the standing local "aliquota" was fixed for each comune. [53]

Reaction came immediately with the comune of Rome imposing a policy which doubled the number of taxable products to be imported, including industrial manufacturers, an example which was promptly followed by Palermo and Bari. Francesco Magri commented that "these examples would certainly have been copied by many other comunes had commercial and industrial organizations not intervened against applications for local tariffs on manufactured goods. The Industrial Federation of Lombardy was the first among these groups." [54] The government responded by "implicitly" accepting the FIL position, and prohibited local comunes altogether from

taxing imported manufactured articles, excepting only the comune of Rome, and this concession was given only for the year 1925.[55]

Important action was also taken by the employers' federation of Lombardy, in collaboration with their counterparts in Liguria and Piedmont, for reform of comunal charges on bill posting and industrial advertising. As was the case of tariffs applied on the importing of manufactured articles (the aliquota), charges on bill posting had been used by local administrations as an effective means of balancing their budgets. Working in collaboration, the employers' groups of Lombardy, Piedmont and Liguria established an inter-regional committee to investigate the stabilization of rates on industrial advertising, and a report to a ministerial commission was submitted, fixing national standards for the application of advertising tariffs.[56] In all this work of reform, Magri emphasized in summing up the work of the employers' groups,

> the Federation(of Lombardy) has certainly made a valid contribution to industrial development. And in their relations with the work force (the industrialists) have achieved a closer collaboration, which is an indisputable premise of social pacification.[57]

As Francesco Mauro had emphasized in his major work of management theory - Il Capo nell'azienda industriale - it was not enough for a man to possess all the characteristics of an efficient leader - the environment in which he operated had to be organized in such a way that these characteristics could be realized in practice.[58] The analogy was made of observing a stuffed animal in a natural history museum, and studying the same animal's behavior in its natural environment. "This," Mauro wrote, is the reason for the chosen title of the book: The Manager in the Industrial Firm."[59] For technocratic and corporatist reformers trained in the procedures and techniques of modern engineering and management, this "environment" appeared at last to be in the process of being realized in the early 1920s. The functional fragmentation of social classes, made

possible and inherently modelled after relations of technological interdependence in the economy, would at the same time lead to a new social solidarity, in the same way that the interdependent components of an efficiently designed mechanism were physically arranged to perform determinate functions in the service of a goal outside the modular operation of the components themselves. The corporatist social arrangements that fascism advocated would finally provide the bridge between the technical, economic and social worlds that was the challenge presented by the new systems of science-based and mass production industry. And the theoretical raw materials to be used for the construction of this bridge would be the new discipline which represented both a revolutionary technique for efficiently organizing the authority structure of any collective activity, as well as forming a chapter in the history of engineering: modern management:

> Taylor himself gave the most lucid definition of scientific management, when he stated that it represented a rational combination of elements which could be summarized as follows: science not empiricism; harmony not discord; cooperation not individualism; maximum production instead of restriction of output; and development of every person's capacity to the highest level of efficiency and prosperity.
>
> Could he not perhaps have been a precursor of fascism in the field of scientific management? [60]

Such reform schemes and debates of the early post war period on the function of the political state in an evolving corporatist economic structure - arguments that were never resolved at an institutional level during the inter-war years - in large part defined the terms of reference for an amorphous and multi-faceted reform discourse in fascist Italy, and were intimately connected to the efficiency movement and technocratic political ideology forming within industrial reform circles, and in particular within the engineering community. The structural weaknesses of the Italian economy determined that the political problem would be formally resolved through the mystification of the transcendent authority of the party, and in the economy a form of "efficiency" would be reached by the repression

of labour. The concept of "efficiency" has no meaning at all if not a relative one, and the political resolution of economic conflicts was a well tested strategy of social organization in clientelistic Italy. [61]

If, in the United States of the Progressive era, the corporate ideology of technocratic social organization and a responsible social order took the form of a "new liberalism", [62] in Italy - lacking the resources, technical capacity and political homogeneity that localism and traditional clientelistic manoeuvring had blocked - the same basic ideology assumed the apocalyptic tones that the contradictions of development had engendered. The result, in sum, constituted a vision of an authoritarian social order endowed with the indisputable legitimacy of functional rationality. In the engineering reformist literature, as elsewhere, opinion was divided on the most efficient means on arriving at the desired goal, and these divisions were mirrored and reproduced in the incomplete and unresolved institutional innovations that characterized the entire fascist period. The same tensions that had created the technocratic impulse were the best evidence that the structural preconditions for the elimination of "politics" from social mediation were a very long way off indeed. The end result was a reform formula which wanted the best of all worlds, and ended by institutionalizing the contradictions and enormously widening the gulf between theory and practice in political and economic life that reform was intended to bridge.

In practice, the enforced "harmonization" of particularist interests through the repressive power of the state was the means of ensuring that the process of linking functional factors in the pursual of the "collective interest" would not be interrupted. With the immediate problem of social revolution threatening in the period 1919-1922, "authority" therefore stepped into a causative relationship with "harmony" - "authority" however being conceived in a radically new way: it would be rational because determined by purely functional criteria. This bringing together of "harmony"

and "authority", a combination which by definition precluded "repression", would be elevated to the highest level of political fantasy in the formal conceit that was the fascist corporatist state.

The closing section of this chapter will discuss this ideology as it was expressed by reformers working in the offices of the political administration itself. It is intended to suggest that the dominant reform discourse in "corporatist" Italy was not confined to interventions at the margins of political administration, nor indeed to fascist ideologues. Rather these ideas were circulating in the reports and analyses of technical bureaucrats operating within the administrative structures of the state. For many engineers and like minded reformers in post war Italy, the conception and organization of the plan for the corporatist state was the final testimony that their ideas for change had "arrived." Evolving in parallel with the ideology of these individuals however there was, as part of the consensus of reform opinion which dominated considerations for social change in the period, an exclusively administrative component. It is at points such as these that the distinction between industrial and administrative organization theory, political management and the corporatist conception of social reform appear to lose their autonomy as analytical categories in the climate of reform in fascist Italy.

Public Administration and the Rationalization of Power: The Reform Vision in the State

Where will it end? Soon we will reach a point where the letters we write will have to be delivered in person!...The technicians of the civil service, stripping themselves of their bureaucratic garb, must confront and study the problem (of the public services) from every point of view and propose necessary reforms. Public opinion will certainly be with them.
(Ingegneria Italiana, n. 90, 25 Sept. 1919, p.149. Comment on a strike by postal workers.)

When one thinks that the army provides the best example of a fixed hierarchy; that a flexible hierarchy would compromise and reduce efficiency; that administrative organization is as delicate and important as military organization; and that both should be protected from changes that could weaken them - one must conclude that hierarchy is preferable to anarchy.
(Renato Spaventa, Burocrazia, ordinamenti amministrativi e fascismo preface by Alberto De Stefani, Milano, 1928, p.6)

We must give Italy its due credit for primacy in the field of scientific management, particularly regarding its application in the public administration...The government has tenaciously set about realizing a transformation through interventions...which have already begun to yield tangible results...Fascism has offered a new conception, not of unconstrained individual freedom...but a vision of the state as organizer and and unifier of individual interests, by bringing together the country's (productive) elements in a fascio for the benefit of the nation as a whole...In the field of economic organization - first in America, and now in Germany and England as well - the principles of fascism are being followed in practice without even being aware of it. This is due to fascism's spirit of realism.
(Silvio Molinari, Profili di una organizzazione scientifica del lavoro amministrativo, Venezia, 1928, pp.30-31).

Peoples of the north have observed with great interest the changes taking place in a Mediterranean state that has completely transformed the concept of the civil service...the new concept states that the nation is a productive unit, and that questions of a moral nature must be considered and resolved both in the field of domestic administration...and in the area of international relations. We must express our congratulations to Italy for having introduced into public law...the exact, positivistic, technical and moral values of work, order and discipline. This exact method of total order represents the science of energetics in general, and follows the doctrine of scientific management as articulated by Henri Fayol.
(Dr. Zmavc, member of the Masaryk Academy of Prague, speech to the Third International Congress of Scientific Management, Rome, 1927, Atti del III congresso dell'organizzazione scientifica del lavoro, roma, 1927, p.III.).

Writing in Critica Fascista in July 1924, Ugo d'Andrea made the observation that the Italian state had never had a strong and effective administrative framework, and weaknesses in the administrative organization of local and national political structures implicitly meant that it would be impossible to endow any government with effective powers of action or legitimacy: "A state cannot be governed if it is not administered well, both in its central organs and in the periphery, and in the provinces and communes." [1] The problem of administrative chaos in Italian political institutions had been revealed essentially by the contrary trend emerging in the organization of civil society. As Adrian Lyttleton commented:

> The structures of the Italian state evolved more slowly than those of Italian society...the general trend between 1870 and 1920 was toward the growth of parties, unions, associations, and a free press; the administrative state remained, and the mechanism of parliamentary control over its operations was imperfect in the extreme. [2]

D'Andrea pointed out, as had Fayol before him, that one of the major problems of ministerial and administrative instability was inherent in the parliamentary system itself: positions of responsibility and authority were created, filled and changed according to political whim, and not according to competence in the material at hand. [3] This was clearly a very long standing problem of social organization, evolving in step with the institutionalization of the parliamentary process itself.

The emergence of fascism as a social reform movement coincided with the diffusion of a new managerial model for social and economic organization which also touched the meditations of reformers operating within the state apparatus. In these meditations, one of the new protagonists of political life would remain the bureaucrat, but of a radically different stamp: responsibility and efficiency would inhere in the overall structure of the state because its functionaries would possess the expertise to guarantee the integrity of the political structure as a whole. The idea was to form "a method, a style, a habit of mind, a professional ability...

in the state's functionaries...This is the age of method, it is the age of 'routine' (english term used), ordered, tenacious and patient. It is the time of humble but great virtues." [4] The fascist state was to be the first political expression of the new managerial model: order and efficiency were for the first time going to be matters of administrative organization, and institutionalized at the political level through the "unity of command" concept applied to the structure of the fascist state. "The creation of a managerial class," Roberto Cantalupo wrote in Gerarchia in early 1926, "constitutes the ethical and political essence of the historic program of fascism." [5]

Management theorist Silvio Molinari made the connections clear between the fascist conception of political organization and the Fayolian doctrine of organization is some writings of 1927. In an article in Francesco Mauro's journal L'organizzazione scientifica del lavoro, Molinari emphasized the importance of distinguishing between the "active" and "control" functions of administration, corresponding to the "line" and "staff" categories of Fayol, who, in turn, had taken the model from the military. [6] Similarly, in the case of political administration of production sectors - for example, in the organization of the railroads - internal norms for the sector and managerial strategy would have to be determined by experts operating autonomously within the specific "autarchic" department, with the state functioning as a control element, external to direct management but ensuring that standards would be followed. [7]

With reference to the implementation of such a model, Molinari praised the legislative measures of the 23rd october, 1925, which had endowed the government with powers of monitoring the execution of policy in the "autarchic" services, citing in particular the health care administration. He was eager to point out, however, that the structural integrity of this hierarchical system was dependent on a high degree of

"self-control" in the internal operation of the administratively autonomous services: having been efficiently organized and administered at a very detailed level of the overall hierarchy, control over the behavior of the whole would essentially inhere in the structure of the totality. [8] In the implementation of the strategy of "self-control" at the institutional level, Molinari lauded the Belgian Ministry of Agriculture, which had been a pioneer in this material. [9]

The essence of fascism as a doctrine of social administration was repeated by Molinari in a more extensive treatment of Fayolian theory in his work, Profili di una organizzazione scientifica del lavoro amministrativo Restating the theme of a necessary distinction between "active" and "consultative" or control organs forming the two basic levels of the political structure - the first he called "enti-autarchici" - Molinari observed that in such a system of organization the root principle of scientific management that "every action of the worker will have to be preceeded by one or more operations of management" was reproduced at the more general level of political administration. [10] Molinari pointed out that this principle applied from the very detailed level to the upper layers of administration - adding Fayol's essential contribution of ensuring "unity of command" by having all orders emanate from a single source for any given organizational structure - constituted a virtual military model for civil administration. Overall, the model formed the means through which the basic requirement of the times - class collaboration - could be realized:

> Collaboration, considered scientifically, is founded on the principles of specialization and coordination. Specialization ensures that every agent has a determined task; coordination tends to harmonize the various operations and direct them to the realization of a pre-determined goal, conceived as a synthesis of the numerous individual operations...collaboration is nothing more than the factor that eases such coordination... and it is clear that this can in no way be considered to violate the principle of authority, the principle that lies at the base of scientific management. [11]

More importantly, it was fascism's insight to have perceived the implications of such a system for social order and efficient administration, and acted on it in the conception of the corporatist state:

> The organizations charged with coordinating the autarchic services, according to the splendid federative concept of fascist origin, are undoubtedly the most suited to realizing... the principles of scientific management at the level of the communal and provincial administrations, thus freeing them from the dross of empiricism... [12]

In fascist Italy, the motives and the goals were to liberate public administration from the curse of "politics", by applying the same functional criteria for efficient organization as had been made possible by the employment of scientific management in private industy. [13]

The relative technical backwardness, low productivity and low income levels in Italy, however, simply did not require the social infrastructure which government by business associations and efficiency principles had responded to, for instance, in the United States of the same period. Construction and maintenance of costly road networks and the administrative structures which accompany them serve little purpose if there is almost no traffic to bear. The structure of Italian industry was primarily a trade in intermediate inputs by large scale producers, and investments in social infrastructure required by the productive capacity of American industry were simply unnecessary in Italy. Reform of specific laws, such as the legislation concerning the "aliquota" on the internal movement of goods as discussed earlier, were the targets of business mobilization, but direct investment in and management of political instruments made little economic sense. Simple manipulation of the legal system when required was less costly and served the needs of the moment. Paradoxically, this was precisely one of the basic features of social and economic organization in Italy which helped to lift a non-event - government by "competenti" - to the level of being an important component of the political ideology of the fascist movement. Whether mere posturing, this glorification of

the technician and his methods, the engineering-managerial ideology which can play such a potent role in societies with a history of contradictory development, even made its way into the public statements of Minister of Finance Alberto De Stefani.

In a February 1923 speech to the almost absurdly marginal Association of Customs Officials, De Stefani declared:

> You belong to that category of men that do not consider science only in the abstract, uprooted from its base in physical nature... (and detached) from its practical applications. We hold such men in great regard, because only through technology does the word become flesh and concrete sentiment potent reality. 14

The director general of civil administration during the early years of fascist rule, Senator Pironti, pushed such a discourse even further when referring to the figure that had until then been regarded as little more than a target of unmitigated scorn:

> Under fascism the office bureaucrat is no longer considered a more or less superfluous time waster, and a man who is little more than a burden on the Treasury. (Instead he is now regarded as) a man who, in the exercise of his duty, sometimes reaches the peaks of civil heroism. 15

The preposterous extravagance of this rhetoric should, if nothing else, attest to the seriousness of the problem of bureaucracy, and the fascist appropriation of this discourse had been made possible in part by reports and efficiency investigations carried out prior to the black shirts' seizure of power, by officials working within the labyrinthine structure of the state administration.

One such report was written by the engineer Antonio Sibilla, president of the board of directors of the National Association of Government Engineers in June 1921. [16] The Engineering association which Sibilla represented had been created in 1918, and shortly after was made into a "corporazione" of the National Association of Italian Engineers. From its origin, Sibilla's association had been occupied with studying reform of the technical services of the state, "to render them more productive, less costly, and to remedy the grave moral and economic uneasiness that, in

varying degress, is felt by all government engineers." [17] All the efforts of the engineer reformers had, however, been in vain, Sibilla reported, because of the complete absence of technicians in the official bodies proposing administrative reform. Moreover, it was pointed out that all preceeding reform commissions had never concerned themselves with technical services and offices, only with reform of the central adminstration and its dependent services. This criticism was also applied to the investigation carried out by Senator Villa in early 1918, which Pietro Lanino had violently attacked in Ingegneria Italiana.

Having tired of these non-reforms and the neglect of the engineer's contribution to organization modelling, the national association of engineers called a congress in Rome for December 1920, to confront the problem directly. It was at this point that government engineers of the various administrations united in a corporation, and joined with the already existing national association of engineers. A Central Coordination Committee was formed, composed of the president of the various engineering corporations within the national association, and was entrusted with the job of presenting the demand to the government that all engineers be considered equally as regarded pay, professional competence and working conditions. In his report, Sibilla suggested that government engineers could be assisted "morally" by granting them the same professional status as the engineers' ubiquitous object of contempt, the treasury lawyers, as well as magistrates. [19] As a gesture of genuine reform, it was proposed to unite all the technical organizations operating under the state's jurisdiction (a total of twelve) into a single technical body, under the direct authority of a Central Technical Office, which would be given the responsibilities and title of a Ministry in itself. This type of organization, Sibilla assured, would guarantee efficiency in the technical

conduct of political offices. [20] The author had to add however that "we do not hide the fact that such reforms would require transformations that are perhaps too radical...as well as the fact that we feel neither prepared nor authorized to put them into more concrete proposals." [21] Sibilla decided, therefore, to limit his report to reform suggestions of the technical services of the Treasury only.

The major points cited were to decentralize the administration and reduce the size of the bureaucracy. This would be accompanied by endowing individual offices with more responsibility and autonomy, and, following Fayol's principle, the central organs of the relevant Ministries would have the overall function of determining strategy and checking its implementation at the local level. The second point proposed elimination of many superfluous offices created during the war; and the third point concerned accounting.

Regarding the final proposal, at the time Sibilla's report was written there were three separate offices controlling treasury accounts: at both the provincial and ministerial levels, and at the national level the centralized Corte dei Conti had overall control. Since the Corte dei Conti was often not competent, through lack of contact with local needs, to make budgetary decisions for the various regions, Sibilla suggested unifying accounting procedures and establishing a single office at the treasury to deal with accounting problems. [22]

It was further proposed to streamline the internal passing of orders and communications within the political administration. The author advocated introducing "classification and filing procedures for documents that have been adopted so advantageously for speed and economy of service by private industry." [23] In addition, and as regarded personnel, Sibilla proposed hiring out various routine activities - such as copying - on a sub-contract, piece-work basis. Mandatory retirement at sixty would also

be introduced.

In summary, Sibilla noted that

> Taylor has taught, in private industry, how to raise the output of human labour to the maximum, by studying and disciplining the individual elementary movements of every job. It will therefore be necessary to completely review the disordered muddle of dispositions, regulations, service orders and circulars that are issued (in our administration), and re-root them in a single and standardized complex of norms, inspired by the most modern criteria of labour organization. [24]

Confronting the objection that the administrative function was inherently antithetical to the technician's mentality, the author called such assertions "opportunistic", and pointed out that the best evidence against this view was the administrative success of engineers who filled the top managerial positions in the large corporations. [25]

In a speech to the Senate during the same period, Senator Rava - who would later, together with Giuseppe Bottai, be a member of the press office of the Comitato Centrale of the Consigli Tecnici - [26] raised some of the same themes, concentrating in particular on problems of redundant personnel in government administration, especially as a consequence of the war. Rava favourably cited the Treasury Minister De Nava, whose financial report of 1921 had advocated the use of "autonomous" state services (for example, the telephone, telegraph and rail systems) which would be efficiently organized to enable them to be"self-supporting." [27]

Secretary of State at the Council of Ministers Acerbo made his own contribution to the debate on administrative reform, noting that the goal must be to organize the public service in such a way that "a materially and morally strong state is created, simple in organization, rapid in movement, efficacious in its actions, and which would carry a solid hierarchy as a consequence." [28] The essential pre-conditions of reform would have to be to free the state from any monopolistic economic activity, delegating these responsibilities to private operators, and to endow

local authorities with decision making powers over questions that directly concerned them. The central organs of the state would be responsible, as Sibilla had proposed in his 1921 report, only for managerial control, determining the overall direction and strategy of the component services.[29] Again, the language of industrial management was invoked, with Acerbo accenting the need "to unify, through simplification, the consultative and control function of the general administration of the state, and unify the organization of the treasury..."[30]

Despite the general disdain of the engineering community, by the time fascism had taken possession of the state, even the "lawyers" had begun to enter the reform picture, adopting whole-heartedly the efficiency discourse which their critics had invented. In an analysis written soon after the fascist rise to power, but undated in the Archive, the representatives of public service workers, Giuseppe Montemurri and Aldo Lusignoli - who would also be a member of the press office of the fascist consigli tecnici[31] - had also emphasized the need for bureaucratic decentralization as a prerequisite of efficient administration.[32] The two attorneys began their report by specifying that "bureaucratic decentralization can only be based on technical and functional criteria, necessitated by the technical exigencies of the administrative function.[33] The basic feature of "functional bureaucratic decentralization" was that of an intermediate authority - for example, police headquarters in relation to the Interior Ministry, or provincial administration of the post office with respect to the central Ministry. And in identifying and fixing local authority and responsibilities in terms of function, such structures would guarantee "competence" in the relevant material, as well as eliminate the confusion and inefficiency generated by nebulously defined hierarchies.[34]

Two further points emphasized by the authors, expressed in the obscure diction that was such an intrinsic part of the mystification process that went into the invention of managerial rationality, were "technical and administrative unity and continuity" (of the central state offices) as a condition of decentralization; and secondly, the mechanization of services as a "factor of administrative simplification". On the second point, Montemurri and Lusignoli insisted

> on recommending the adoption and extension, in all branches of the public administration, of the principles of mechanical and psycho-technical organization that go under the name of Taylor. (These principles) already put into effect by the largest banks and foreign administrations, can also be usefully applied in the Italian public administration, once having determined, case by case, the appropriate "factors of adaptation", which will have to be specified by the experts in this material.
>
> Saving of human labour, putting human activity itself to better use and, in particular, establishing regularity and precision on the job would be the unfailing consequences of a well planned adoption of such a system, and the corporation (of office workers) would like to see it implemented as soon as possible. [35]

The analysis was pursued with a discussion of "control" mechanisms in the administrative structure. As was the case in the report submitted by the engineer Sibilla, accounting procedures were severely criticized, in particular for violating the managerial principle of "unity" in the command structure, because of the absence of a centralized accounting bureaucracy. The system of parallel and redundant offices (the Ragioneria di State and the Corte dei Conti) not only was wasteful of resources, it also broke the "indissoluble connection between management and control", which was inherent in a unified and centralized hierarchical structure. "Control," it was explained, "directly pertains to the management of the budget...In as much as the budget is part of administration, it already has in itself the function of self-control, natural, spontaneous and necessary..." [36]

The same notion applied as regarded the question of careers in the adminstration. It was not enough to internally reorganize already existing services; the function of entire departments had to be analyzed in terms of

their relevance to the overall operation of the bureaucracy, and all non-essential offices would have to be eliminated entirely. This was a "basis of reform". [37] Again, having taken such a step, one would be further along the road to creating a hierarchical system of organization whose structure would itself be an inherent encouragement to efficient management. Rather than having to impose discipline and order in the system through the application of measures extraneous to the organization, the desired ends would spontaneously emerge from the organizational constraints of the system itself: "capacity, responsibility, competence must be the consequences and product, and not a presupposition, of behavior." [38]

At the level of the reorganization of an entire ministry, it was essential to have the executive operations of the component services correspond precisely in their responsibilities with the strategic goals determined by the central "staff" offices. "This," the authors argued, "has been understood very well by the Interior Ministry, which has seen to the formation of a single hierarchy from the centre to the periphery, from the Ministry to subprefecture." [39] Fragmentation and specialization by function at the lower hierarchical levels was the presupposition of integration and interdependence at higher levels of organization: as it had proved itself the instrument of order and efficiency in the world of engineering and industry, such a theoretical model would also be an indispensable tool in resolving the question of political organization:

> The process of perfection through specialization is not only a law in biology and economics today, but a practical truth in administration as well. The best administration organization corresponds with the greatest specialization, which is imposed by the necessities of modern life and the expansion of the services offered. [40]

The key idea, as FIAT manager Mario Fassio wrote some years later, was "control", which scientific management had made possible to realize as an inherent characteristic of administrative organization. In industry as in government, the principle was universally valid: "Our age," Fassio wrote in 1938, "is the age of control. Control is no longer

only a means to measure and evaluate (performance)- it is also an ideal in the governing of a private firm, and an ideal in the governing of public life." And the integrity of the structure of control would liberate those at the top of large organizations, either private or public, from direct intervention in the management of the enterprise. The military system of "line" and "staff" could thus be realized, and the latter would be free to concentrate their attention on fixing goals and determining strategy. "It is a giant and perfect machine," Fassio declared, "it" being conceived as any well ordered organization: "one need only keep an eye on the machine to ensure that its operation is always regular and perfect." [41]

By the time of the International Scientific Management Conference in Rome in early September 1927, at which even Mussolini was present, administrative theory had, as ideology, become an operational part of the fascist conception of political organization. Giuseppe Miceli of Critica Fascista, who with the administrative reformers Rava and Lusignoli had worked with Bottai in the press office of the consigli tecnici, reported on the management congress under the heading "Corporative Review". [42] For Francesco Mauro, the managerial method was finally receiving its due as the revolutionary social doctrine of modern society:

> After the epic struggles our master Frederick Taylor had to endure with workers' organizations - to make them understand that scientific management meant class collaboration and not antagonism - the presence of the honourable Cucini here (Bramante Cucini, fascist deputy and advisor to the Italian National Institute of Scientific Management, ENIOS) is splendid proof of our victory in the battle, since it demonstrates that the fascist corporation are working in continuous collaboration with other interested parties in the problems of production... This is really the best proof of the success of our movement. [43]

As far as the internal operations of the political administration were concerned, however, all this conservative revolutionary modelling came to nothing. In October 1926 Mussolini himself nominated a committee, presided over by the ex-minister of Finance De Stefani, to study "the perfecting of labour and control methods in the state administration." [44]

The initiative was to apply scientific management to all branches of the state services, given that the same problem existed in both private industry and political administration: adapting the machine to the worker, eliminating redundant operations, the need for "automaticity" of control, time study, a rational division of labour and "scientific" personnel selection.[45] Until this point administrative reform had always been conceived in such a way that specific services had never been analyzed for their relevance, reorganization was always geared to the salvaging of careers to satisfy the bureaucratic "love of the quiet life and a horror of responsibility."[46] Tenured jobs in the civil service had never been called into question, and administrative reorganization had always been formulated in terms of maintaining these posts at all costs. The consequence was to have fixed in place a bureaucratic structure permeated with useless mediators, and which was inherently hostile to the formation of a sense of responsibility in employees. This was in blatant contrast with the organization of a private firm, which could clearly not afford such waste, where every employee "identifies his own interest with that of the firm."[47]

With the overall inefficient structure of the bureaucracy left untouched, there was little to be gained in modernizing such areas as internal communications, which continued to be passed through public offices in written form, where the installation, for example, of a telephone system would have saved much time and effort.[48]

As part of the fascist gruppo di competenza working on administrative reform, Ettore Lolini had submitted a report in early 1923 to the Grand Council, entitled "Proposal for reform of services, controls and hierarchies in the state administration".[49] This proposal was more or less a restatement of ideas already laid out in an article Lolini had written for La Voce in 1919. In March 1923 the plan was approved by the Grand Council, and paased on to the Accounting Office of the state for implementation. By November of the same year, legislation was in fact

introduced for reorganization of the administration. However, and as Lolini himself complained in 1928, the fundamental point of first reordering the actual services provided was neglected, and reform was still linked to the preservation of career positions in the bureaucracy.[50] Moreover, the fragmentation of accounting procedures had still not been dealt with, and budgetary decisions for a given service continued to be a divided responsibility among a number of separate offices.[51]

As with so many other legislative interventions in Italy, both during and after fascism, the law of the 16th of August, 1926 on internal administrative reordering suffered the same end as the wider-ranging program of the fascist gruppo di competenza and the other proposals considered here. Apart from blocking the hiring of new personnel in the civil service, this law decreed that all ministries, in collaboration with the finance section, were to recast the organization of services in each of its respective offices, as well as introduce "accelerated" work methods in all sections.[52] To carry out this project, Alberto De Stefani was appointed head of a reform committee in October 1928. Critica Fascista was optimistic about the possibilities of such an initiative, observing that

> one has to consider that while on the one hand the work of the bureaucracy has changed greatly in quantity and quality, given the complicated functions assumed by the state; at the same time, it is important for the public administration to adopt, in terms of methods and technical innovation, the lessons of experience in the large private organizations. The problem is not only one of men, personnel, bureaucracy...but of organization, mechanical devices, and of methods.[53]

De Stefani's report was completed and submitted in April 1929, but four years later reformist attorney Raffaele Numeroso could still write that "in the majority of public offices work is still done with means and methods that are absolutely incompatible with the reality of modern life."[54] In only two offices of the Ministry of War, because of the "tenacious initiative of a service chief", were such methods introduced.[55]

By this point, however, the identification of fascist ideology with managerial theory seemed to be complete, substituting, in the

rhetorical interventions of administrative reformers, for a stubbornly unchanging and ponderous bureaucratic wastefulness in the real organization of political institutions. Almost in the same breath as the statement quoted above, Renato Spaventa could write that the "renovating force of fascism smashes against old habits of mind (in the bureaucracy)". [56]

As Fayol had insisted upon, and the Neapolitan bureaucrat Numeroso repeated, the "point of departure" was always the formation of managers: "The movement cannot begin from below, from the masses. The new light, the push, the teaching must come from above, from the managers." [57] The formation of this élite - to be constituted on the principle of social duty and an authoritarian and centralized system of government (emphasis in the original) - was particularly important for the functioning of the corporatist state "in the present conditions of political and administrative centralization." [58] As a practical measure it was suggested selecting out 150 to 200 administrators from the ministries and public service and training them in special institutes in the principles of Fayolian reform. [59]

In 1933, as ten years earlier, reformist faith in administrative élitism had lost little ideological ground, indeed it had if anything been strengthened by the all too evident practical failures, and the strict identification of managerialism with the fascist vision of social reform. Corporatist, legalistic and repressive measures continued to serve as substitutes for the technical modernization that "real" managerial reform presupposed, and the weaknesses of the one fed the pretensions of the other. The organizational assumptions inherent in the "best" technological practices in rapid evolution on the international scene during the fascist years had as yet touched little the Italian economy, and political gestures and interventions - such as Giuseppe Bottai meeting with the editorial board of the review Mente et Malleo in Turin in 1930, an industrial efficiency publication associated with the engineer and FIAT manager Mario Fossati's institute of scientific

management - were symptomatic of the enduring function of legislative, political and organizational substitutes for technical dynamism in stabilizing the social order. [60]

In the early period of Italian industrialization, "inappropriate" development had induced protectionism; the inheritors of this patrimony in the technologically determined competitive environment of the 1920s resorted to adopting exclusively organizational reforms - often involving simply personnel cutbacks or open repression - disguised with the beguiling fig leaf of "efficiency."

Conclusion

The challenge of planning and regulating the uncertain social order of science-based industrial capitalism, through using the same instruments - engineering techniques - responsible for the uncertainty, has been one of the most curious paradoxes of our time. For reformers in the 1920s, the problematic as defined by individuals like Thorstein Veblen was viewed as a function of development in all countries passing through the second industrial revolution, and the promise that science held out for the re-molding of social hierarchies. In considerable part, the argument was formulated and its terms defined in the United States and diffused as a packaged discourse to Europe - not, to be sure, as a simple transfer of ideas, but as an effect of the process itself of American economic expansion in the 1920s.[1]

A vision of planning based on a form of reasoning not dissimilar to that employed by the corporatists in Italy was indeed widely experimented with in the inter-war period. One such experiment, which formed part of the constellation of elements that went into the articulation of the corporatist discourse was the "Vision of an Associative State", conceived by Herbert Hoover at the U.S. Commerce Department in the early 1920s. As George F. Doriot, assistant Dean at the Harvard Graduate School of Business Administration, pointed out in 1927, Hoover's work at the Commerce Secretariat

> brought home to European countries the vast possibilities inherent in cooperation between government and industry. The effect of industrial development in the United States upon European thought can hardly be overestimated.[2]

In essence, Hoover's plan involved "an incipient form of

'indicative planning' based on corporatist rather than classical economics", an "adjustment of an engineering approach to political realities." [3] The motivating force behind Hoover's conception of institutional reform was his perception that "against the forces of scientific rationality...had gathered an alliance of 'vested officials', 'paid propagandists', and selfish interest groups, and these enemies of progress had created a 'confusing fog of opposition'".[4]

On the basis of his war-time engineering experience, Hoover saw the answer to this problem in the assimilation of trade associations into the body of government itself: "the commerce department was to become a department of economic development and management; other agencies would still be responsible for special sectors of the economy, but commerce would serve as a general policy coordinator." [5]

The most important question, of course, was who was to do the planning and coordination, and the answer, as obvious as it was destructive of the concept of the "associative state", was to staff the commerce department's offices with industrial experts and representatives of the sectors to undergo reorganization. Without examining the details of the planning failures and the individual interests concerned, Hoover's vision disintegrated, as did the later reform work of the NRA under Roosevelt, when confronted with the inescapable fact that what appeared to be a relationship of antagonism - business and engineering - was in fact an identity. In the end, trying to graft engineering principles onto the categories of government only seemed to implicate the public sector in the competitive struggles of business interests. In practice, as Ellis Hawley summarized, "the overall effect was to strengthen existing organizations, to confirm and reinforce private controls already in operation, not to create new controls

in previously competitive industries...the practical result was government by the larger concerns, or by the older, larger and more strongly established trade associations." [6]

In France during the same period a similar experiment was attempted at the Ministry of Commerce and Industry under Etienne Clementel. For their success, both the French and American reform schemes obviously depended on the cooperation of technical personnel, which appeared inevitably to invite competitive and speculative "business" interests into the streamlined world of corporatist dialectics. In any case, in France as in Hoover's America, "business...came to regard the commerce department's program as a covert attempt to impose dirigisme on the economy"; [7] and under the engineer Louis Loucheur's direction of the Ministry of Industrial Reconstruction in the early post war period, Clementel's ideas for a type of "associative state" modelled on the cooperative interplay of functional, corporatist hierarchies amounted, in the end, to little more than a languid sermon on the potential of an economic system which seemed to dizzyingly reproduce itself by systematic self-negation. As Richard Kuisel summarized the problem:

> Planistes sought to ground an economic order in a rational man-made economic budget and an institutional system of direction that was at odds with a market economy...There is a tension between institutionalized rational management and the free operation of the price system. Reason, controls, and forecasting were to replace, or at least modify, natural or automatic mechanisms that, according to a market philosophy, should remain beyond human intervention. [8]

Perhaps no single social group was more aware of these tensions than engineers engaged directly in production, simultaneously serving a double-edged concept of efficiency - technical and economic - and whose ultimate aim had to be to bring the two into harmony, to reproduce the social system that had produced them.

A figure such as Charles Steinmetz, chief engineer at General Electric Corporation and lifelong socialist reformer, represents well the point. Well placed as he was to experience first hand one of the central contradictions of the late capitalist economic order - the systematic and rationally ordered administration and reproduction of chaos-Steinmetz ended by burrowing deeper into the contradiction for the answer, finally asserting that the modern industrial corporation, the institution which played host to technical rationality, "was the most efficient means of making individual development possible in our present state of civilization." [9] Carrying the momentum of the argument forward onto a higher level of meaning, Steinmetz arrived at a position which placed him in the ranks of the reform movement in early twentieth century America which James Gilbert termed "collectivist thought". [10] This referred to the broadly based movement whose program for change was founded on bringing social and political categories into closer alignment with technological ones - that "modern social organization ought to emulate the contours of industrial organization." [11] Steinmetz himself expressed the vision without ambiguity: "All that is necessary is to extend methods of economic efficiency from the individual corporation to the national organism as a whole." [12] Industrialized science, as expressed through the modern corporation, not only provided the tools for improving economic efficiency, it also could inform the conceptualization of a "science of cooperation" for civil society. "By the stream of human stuff," wrote Erwin H. Schell, engineer and professor of Business Management at MIT,

> that flows into our industries we find the psychologist, the psychiatrist, the statistician, attempting to weigh and to measure the human molecule. Before the process, we again find science at work in the persons of engineers, mathematicians, accountants, organizing equipment, men, and processes in delicate balance.
>
> We see that science thus stands at the gateways of

> production, relating and adjusting elements and activities in order that the processing itself may be simple and free from difficulty. Under these exacting corcumstances, routines have become less exacting and the demands upon science for the maintenance of complex control systems have lessened. the use of science in control is giving way to the use of science in organizing for self-control.
>
> The future of science in production seems indeed auspicious. It is in the area of human relations that it is beginning to make one of its major contributions... Later years will, I believe, look back on our oncoming era as one of the most significant in American industrial history because of this highly significant development in the science of cooperation. [13]

In general, optimism for a technologically inspired future went hand in hand with a candid faith in the emergent corporation as the prototype of the good society. As James Gilbert observed:

> Elaborate organizational patterns and corporate power frightened such intellectuals not in the least. The social relationships within the corporation, once abstracted from self-interest and profit making, looked a great deal more promising than the traditional social divisions and organizations that then divided and dominated the United States. For one thing, the corporation was organized for use, not waste. This being so, problems of regionalism and special interest appeared to have no hold. Science, not personality, political pressure, or ideology was the backbone of this new organization...the functional categories of worker, owner, manager, and - on the outside looking in - consumer, seemed to produce strong, self-interested commitments to the good of the whole. [14]

For the most part, the process was viewed as inevitable and pre-determined, though some commentators such as John Dewey saw room for choice:

> We are in for some kind of socialism, call it by whatever name we please, and no matter what it will be called when it is realized. Economic determinism is now a fact, not a theory. But there is a difference and a choice between a blind, chaotic and unplanned determinism, issuing from business conducted for pecuniary profit, and the determination of a socially planned and ordered development. It is the difference and the choice between a socialism that is capitalistic and one that is public. [15]

Others carried the reasoning on to a different plane, making specific reference to contemporary political phenomena: "both fascism and communism are gigantic undertakings or adventures in what might be called sociological rationalization, corresponding to the sort of thing

that has been carried so far in the advanced industrial nations in the fields of technology...the ruling principle would be instrumental rationality." [16]

However, the failed experiments of Hoover's commerce secretariat, and the similar reform efforts in France and Italy, seemed to suggest that "instrumental" and "capitalist" rationality were far from incompatible.

It is in such a light, and given such a historical context, that one can read Gualberto Gualerni's statement in 1976 that "fascism can be viewed as an instrument used for the development of Italian capitalism, and for institutionalizing the social structures requisite to it...(Moreover) many of the phenomena ascribed exclusively to the fascist regime were also present in democratic societies." [17]

This is not to say, however, that engineering modelling and its exploitation as ideology had to form such a significant presence in the articulation of social reform ideology in inter-war Italy. Having approached the fascist movement wholly interms of its corporatist-technocratic component, much of this thesis has been an effort to reconcile Gualerni's observation with a concept of historical specificity. I have tried to suggest this dimension of historical specificity in the thesis by invoking the category of inappropriate development. The tension between the two approaches - or the two analytical categories of the generic "technocratic myth-making" of engineer/managers in advanced capitalism, and the historically specific category of inappropriate development - will be evident, and I do not claim to have completely resolved it in the thesis. Clearly, the main problem in this approach is that if the British model was "inappropriate" for Italy, there must have existed a historical alternative which would have been more appropriate to factor endowment, factor prices, class structure, and so on. I have not tried to describe

such a suppressed historical alternative in this study. Such a task would require a much more detailed empirical investigation and quantificatior of factors of production, as well as a deeper analysis of class alignments in industrializing Italy. If the tensions between the two dominant analytical categories used in the thesis have not been entirely resolved, I may perhaps brave the suggestion that they are at least two of the most promising categories with which the corporatist discourse can be analyzed. In the view of Alan Milward,

> fascism was no cancer in the body politic, but a normal stage in the historical and economic development of Europe, and...it cannot be ultimately comprehended on a merely political level. Its form of economic expression and its form of political expression cannot be meaningfully separated... [18]

If the contribution of this thesis rests on simply having asked questions which would help to illuminate how these "forms of expression" might be unified, its aim has been realized.

Footnotes and Bibliography

Footnotes. Introduction

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6. See, for example, Dan Clawson, Bureaucracy and the Labor Process, N.Y., 1981; Craig Littler, The Development of the Labour Process in Capitalist Societies, London, 1982; David Montgomery, Workers' Control in America, Cambridge University Press, 1981; Bryan Palmer, Skilled Workers and Industrial Capitalism in Hamilton, Ontario, 1860-1914, Toronto, 1980; Wayne Roberts, "Toronto Metal Workers and the Second Industrial Revolution," Labor/Le travailleur, 6, Autumn, 1980; Stephen Marglin, "What Do Bosses Do? The Origins and Functions of Hierarchy in Capitalist Production," in Theo Nichols, eds, Capital and Labour, London, 1980; Jon Cohen, "Managers and Machinery: An

Analysis of the Rise of Factory Production," Australian Economic Papers, vol. 20, no. 36, June 1981; Maarten de Kadt, "The Development of Management Structures: The Problem of the Control of Workers in Large Corporations," unpublished doctoral dissertation, New School for Social Research, New York, 1976.

Much of this valuable work has been a sort of collective wince at a perceived prevailing ideology of the "managerial imperatives" of the modern corporate technostructure. If there are such imperatives, the technological development itself was an aspect of a given mode of production which dictated its own requirements. See also Colin Leys, "Relations of Production and Technology," in Martin Fransman and Kenneth King, eds., Technological Capability in the Third World, London, 1987.

7. There is a very full treatment of the problem of technological dependence in the Third World and inappropriate development strategies in Frances Stewart, Technology and Underdevelopment, London, 1977.
The details of the work attempted at Lucas Aerospace are in Hilary Wainright and Dave Elliot, The Lucas Plan: A New Trade Unionism in the Making, London, 1982.

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13. One-Dimensional Man, Boston, 1964, p.195.

14. Gödel, Escher, Bach, pp.694-695.

15. Italian Fascism and Developmental Dictatorship, Princeton, 1979, pp.320-321.

16. Alan Cawson, "Pluralism, Corporatism and the Role of the State," in Government and Opposition, 13, 1978, quoted in Werner Abelshauser, "The First Post Liberal Nation: Stages in the Development of Modern Corporatism in Germany," European History Quarterly, vol. 14, no.3, July, 1984, p.288.

Footnotes. Chapter I. Introduction and Giuseppe Colombo and the Articulatic of the Problem

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2. "Some Tendencies and Problems of the Present Day and the Relation of the Engineer Thereto," Transactions of the American Society of Civil Engineers, 76, 1913, quoted in Edwin Layton, "Science, Business and the American Engineer," in Robert Perucci and Joel E. Gerstl,eds., The Engineers and the Social System, N.Y., 1969, p.66.

3. David Noble, America By Design, pp.52-53.

4. "Giuseppe Colombo," L'Elettrotecnica, 15 April, 1924, no.11, vol.XI, p.238.

5. R. Cambria, "Giuseppe Colombo," Dizionario Biografico degli Italiani, p.213.

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11. ibid., p.41.

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14. Carlo G. Lacaita, Sviluppo e cultura alle origini dell'Italia Industriale, Milano, 1984, pp.14-15.

15. ibid., p.17.

16. Giuseppe Are, "Alla ricerca di una filosofia dell'industrializzazione nella cultura economica e dei programmi politici in Italia dall'Unità alla prima guerra mondiale," in L'imprenditorialità italiana dopo L'Unità. L'inchiesta industriale del 1870-74, Milano, 1970, pp.50-53.

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24. ibid.,

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Footnotes Mechanisms and Methodology: Franz Reuleux and the Theory of Machines

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9. ibid.

10. ibid., p.74.

11. ibid., pp.78-80.

12. ibid. p.82.

13. ibid. p.95.

14. ibid. p.100.

15. ibid.

16. ibid., p.111.

17. ibid.

18. ibid.

19. L'Elettrotecnica, vol. IX, n. 16, 5 June 1922, p.375. Review of Fayol's book, L'incapacite industrielle de l'Etat: Les P.T.T.

20. ibid.

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22. Mario Fossati, Il compito dell'ingegnere nelle applicazioni dell' organizzazione scientifica del lavoro, Torino 1928, p.8.

23. ibid. Fossati himself, together with Vittorio Valletta, Agnelli's right hand man at FIAT, set up courses in scientific management at the Institute of Economic and commercial Sciences in Genova; the

Academia di artiglieria e genio in Turin; and the Industrial institutes of Novara, Biella and Turin. Out of this practical work of teaching, Fossati produced a textbook on scientific management, which was the winner of a competition organized by the Associazione Nazionale Fascista dei Dirigenti di Aziende industriali. A "Fondazione nazionale tecnico-scientifica" had been established, with Giuseppe Bottai, minister of Corporations, as president, to to award a sum of money every year to the "manager who has contributed most to industrial progress," and Fossati's work in the field was given due recognition in 1935. L'organizzazione, January 1930, a.III, serie II, n.1, p.47.

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28. From Bottai's speech to the National congress of the sindacato nazionale fascista ingegneri, Naples, 16-18 October, 1927, in L'ingegnere. Rivista tecnica del Sindacato nazionale fascista ingegneri, vol. 1, no. 5, p.292.
See also Ferruccio Pergolesi, I dirigenti d'azienda nell'ordinamento sindacale (Padova, 1935, p.174), where he quotes Bottai: "The manager, who is in daily contact with both worker and employer, has a coordinating function. In a certain sense, the manager must embody ...the idea of the corporation. And the corporation itself must not only be an institution, a commission, an office: it is above all an operating spirit of social harmony, a consciousness that must be formed in all of us."

29. Giuseppe Bottai, Fascismo e capitalismo, Roma 1931, pp.53-55.

30. ibid., p.58.

31. ibid. pp.90-91.

32. ibid., pp.69-81-82. According to the medievalist academic Gino Arias (L'economia nazionale corporativa, Roma 1929, pp.15-18) it was precisely national unity as a determinate outcome of the hierarchical corporatist organization of economic actors which demonstrated the superiority of the fascist method over the economic nationalism of a theorist like Franz List, who pressed for traditional protectionism in the German states in the 19th century. By institutionalizing the idea that the private organization of production was a function of the national interest in the corporatist economy, fascism had found the mechanism for realizing the long held vision of national unity, without paying the price of high production costs.

33. Bottai, Fascismo e capitalismo, p.35.

34. ibid., p.166.

35. Raffaele Numeroso, Dall'individuo allo stato. Sintesi dell' organizzazione scientifica del lavoro nell'individuo, nella famiglia, nella scuola, nell'azienda, nella corporazione, nello stato, Napoli, 1933, p.62

36. ibid., p.61.

37. ibid. p.63.

38. "Il II congresso nazionale degli ingegneri italiani," L'industria, vol. XLV, no.10, 31 May, 1931, pp.249-250.

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In his biography of Bottai, Alexander J. De Grand commented that, "...important ground was lost on a significant question relating to the way in which technical and managerial staff would be represented in the corporatist system. The industrialists maintained with intransigence that middle management should not have separate representation, and Bottai was compelled to give his approval." Bottai e la cultura fascista, Bari 1978, p.90.

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43. I dirigenti d'azienda, p.45.

44. Jorge Larrain, Marxism and Ideology, London, 1983, pp.17-18-23.

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47. ibid., pp.28-29.

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2. "L'organizzazione è una revoluzione," L'organizzazione, a.IV, n.9, Sept. 1931, p.247.

3. From a speech to the congress of the confederazione generale dell' industria italiana, in Critica Fascista, VI, 13, 1 July, 1928, p.42.

4. The Engineers and the Price System, N.Y. 1965, pp.34-39.1st ed. 1921.

5. Norman Clark, The Political Economy of Science and Technology, Oxford, 1985, p.40.

6. Thorstein Veblen, Theory of Business Enterprise, N.Y. 1965, p.48. 1st ed. 1904.

7. ibid., p.7; Similarly, David Landes highlighted the "burdens imposed by interrelatedness, that is, the technical linkage between the component parts of the industrial plant of an enterprise or economy. In principle, the entrepreneur is free to choose at any time the most remunerative technique available. In fact, his calculus is complicated by his inability to confine it to the technique under consideration. For one thing - and here we shall stress the point of view of the enterprise - no piece of equipment works in a void: the engine, the machine it drives, and the means by which it transmits its power are all built to fit; similarly the number and kinds of machines employed, as well as the capacity and type of channels for supply, transfer, and removal of raw and finished material are rationally calculated in relation to one another As a result, the replacement of one unit of equipment by another, or the introduction of a new device, can rerely if ever be considered in isolation. What is more, the decision on a given change does not always lie entirely within the enterprise but will depend rather, in greater or lesser degree, on the cooperation of outside units."(The Unbound Prometheus, Cambridge, 1969, pp.334-335.)

Such linkages are particularly important in sectors such as the chemical industry, which requires stable utilization of capacity and rapid processing since "the selling value of a product is inversely related to the time it spends in the production and distribution cycle"; and "the development of new products can make inventory obsolete overnight." (Herman Daems, "The rise of the modern industrial enterprise; a new perspective," in Alfred D. Chandler Jr. and Herman Daems, eds., Managerial Hierarchies. Comparative Perspectives on the Rise of the Modern Industrial Enterprise, Cambridge, Mass., 1980, p.216.)

In 1928, Albert Thomas of the International Labour Office illustrated the economic importance of technological complementarity by citing a handful of statistics from the U.S. automobile industry. At that time, this industry absorbed 14% of american iron and steel production; 50% of glass production; 63% of leather output; 1.1% of wood; 25% of alluminium; 12.7% of copper; 21% of tin; 13.7% of lead; 28% of nickel. ("Il rapporto del direttore dell'Ufficio Internazionale del lavoro. La razionalizzazione Organizzazione scientifica del lavoro, a.III, n.6, June 1928, p.430. On Thomas see, Ruchard Kuisel, Capitalism and the State in Modern France, Cambridge University Press, 1981, pp.33-37.)

Such an industrial configuration, however, presupposed certain macro

level economic conditions: "...large scale, mechanized manufacture requires not only machines and buildings, but a heavy investment in what has been called social capital: in particular, roads, bridges, ports, and transportation systems; and schools for general and technical education. Because these are costly, because the investment required is lumpy and far exceeds the means of the individual enterprise, and because, finally, the return on such outlays is often long deferred, they constitute a heavy burden for any pre-industrial economy condemned by its technological backwardness to low productivity. Moreover, the burden has tended to grow with the increasing size of industrial plant, so that today many of the so-called underdeveloped countries are trapped in a vicious circle of poverty and incapacity. The much vaunted freedom of the latecomer to choose the latest and best equipment on the basis of the most advanced techniques has become a myth." (Landes, The Unbound Prometheus, p.335).

See also Frances Stewart, Technology and Underdevelopment, London, 1977, for a comprehensive and important discussion of all these issues, with particular reference to the real possibilities for development in today's poor countries using the capital intensive model.

8. Veblen, Theory of Business Enterprise, p.8.

9. ibid., p.12.

10. ibid., p.18. Another way of expressing the same point would be that "time savings are predicated upon good coordination between the differentiated phases of production, including coordination and processing of information," which greatly increases the importance of communication and control, "since greater indivisibilities may place managerial constraints on economic performance." Clark, The Political Economy of Science and Technology, p.40.

In a historical analysis of the origins of factory production in England - with the theoretical question of the relationship between technology and industrial organization underlying the discussion - Jon Cohen found that "arguments that rely on indivisibilities...are by and large unconvincing. Although some machines may have been too large for use in the home and in need of a central power source to drive them, in most cases causation was reversed; that is, machines that could be used in cottages were modified for efficient employment in factories." ("Managers and Machinery: An analysis of the rise of factory production," Australian Economic Papers, vol. 20, no. 36, June 1981, p.24.).

Probably the question of technological determinism is more a matter of a methodological decision about at which point in the chain of causatio one wishes to begin analysis than anything else. "It has often been said," remarked David Noble, "that modern management was a necessary product of technological development, that it was called into existence by the demands of large-scale production. This is true, but only if it is understood that such technological development was itself an aspect of the development of the capitalist mode of production." America by Design, p.260.

The same basic argument has been applied to the problem of technology transfer to the third world: "The 'social relations of production perspective' also raises further important questions about the transfer of technology. This perspective suggests that the prevailing social relations will in the last resort influence both the technology that is transferred in the first place and the effectiveness of this technology." Martin Fransman, "Technological Capability in the third World: An Overview and Introduction to some of the Issues Raised in this book," in M. Fransman and Kenneth King, eds., Technological Capability in the Third World, London, 1984, 13.

11. Veblen, Theory of Business Enterprise, pp.18-19.

12. ibid., 24.

13. ibid., p.29.

14. ibid., p.65.

15. The Engineers and the Price System, pp.9-18-19.

16. ibid., p.49.

17. Rautenstrauch, quoted in William E. Akin, Technocracy and the American Dream. The Technocrat Momement, 1900-1941, London, 1977, p.56.

18. In commenting on such ideas in a 1933 study - and after the technocrat movement had become little more than a "media fad and political dead end" under the influence of Howard Scott (Noble, America by Design, p.63) - the Italian economist Virgilio Dagnino observed that they proposed, "at least on paper, solutions so radical that Marxism seems a simple schoolboys game by comparison." (Tecnocrazia, Roma 1933, p.3.). Although "the problem...is not new; it is only newer than it was ten, twenty or thirty years ago." (ibid. Epigram introducing first chapter, quoted in english, but without source). This engineers' fantasy, Dagnino thought, should not simply be dismissed as "escape psychology," which was only "a polemical manoeuvre (by the technocrats' opponents) to reverse the terms of a question that is, in itself, very clear...It is clear that the Howard Scotts of this world could not give rise to any 'terrorism' or suicidal mania by themselves, if the existing situation was not already ripe for this type of spirit." (ibid., p.11). Most fundamentally, "one is dealing with how to resolve the following question: what is the place of the machine in the modern world?" (ibid. p.96); and this, in Dagnino's view, was an issue deserving of far more than dismissive ridicule. In the end, however, Dagnino felt that the value of the technocrats' analysis lay more in its identificatior of problems than in proposing practical solutions, since the reality of competing interest groups, of contention over control of social and economic resources, was not confronted by such an intellectual scheme, and played no part in the engineering paradise proposed: "Apart from the fact that the ordering of economic and social relations is not something that can be resolved with rigid mechanical principles, where would the technocrats in the United States find support for a wide ranging technocratic momement?...nothing in today's world allows one to believe that they are destined to take control over social organization." (ibid., pp.90-91).

More specifically, Attilio Cabiati, who had been part of the early fascist movement to establish the consigli tecnici - which were intended to assume similar responsibilities to Veblen's "soviet of technicians" - made the critique that "the error of technocracy is to ignore completely the existence of 'physical' laws in the economy"; which in practical terms meant that "everyone in the economic world works for a utility. Only in the moral world are there figures such as Saint Francis." (preface to Allen Raymond, Che cosa è la tecnocrazia?, trad. Enrico Radaeli, Milano 1933, pp.VIII-XV).

According to Dagnino, such refom schemes as technocracy were a product of a very particular social and cultural environment: "In this Apocalypse for engineers, in this hybrid alliance between the laws of physics and the verses of the bible, there is certainly something

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beyond our (i.e. the italian) way of viewing things. Technocracy is a typically american creation, and we must study and judge it only in terms of the particular social and spiritual climate which gave rise to it." (Tecnocrazia, p.17).

Although Dagnino's presentation of the technocratic momement is by and large balanced and accurate, the observation quoted above, which seems to display a stubborn blindness to a similar movement occuring much closer to home, can only be attributed to the refusal of a certain type of Italian intellectual during fascism to investigate the historical roots, and contemporary features, of the regime under which he lived and worked. On page 47, for example, Dagnino discusses the yellow dog contract in American labour, and in polemical tones mentions that 75% of American workers had no union representation, without however even a mention of the fascist abolition of free trade unions in 1925.

Looked at another way, perhaps this problem also simply reflects, in some cases, a quite basic lack of understanding of the United States on the part of most Italian commentators of the period, including sometimes simple factual errors, and compensated for by exaggeration of a preconceived image. This is a normal occupational hazard of researchers investigating a foreign culture, but in Italy of the fascist period, the unabashed misrepresentation of facts about the U.S. is something which occurs repeatedly in the contemporary literature. Without pointlessly rostering examples, and staying on the subject of technocracy, Giuseppe de Michelis, fascist representative at the International Labour Office, referred to the engineer-imposter Howard Scott as "chancellor" of Columbia University. ("Alba e tramonto della Tecnocrazia," Gerarchia, XI, n.2, Feb. 1933, p.125.).

19. Stephen Hymer applied such categories in looking at the evolution of the modern multinational corporation and the international division of labour, beginning with the factory system in England: "The hallmarks of the new system were the market and the factory, representing the two different methods of coordinating the division of labour. In the factory, entrepreneurs consciously plan and organize cooperation, and the relationships are hierarchical and authoritarian; in the market, coordination is achieved through a decentralized, unconscious, competitive process.

"To understand the significance of this distinction, the new system should be compared to the structure it replaced. In the pre-capitalist system of production, the division of labour was hierarchically structured at the macro level, i.e. for society as a whole, but unconsciously structured at the micro level, i.e. the actual process of production. Society as a whole was partitioned into various castes, classes, and guilds, on a rigid and authoritarian basis so that political and social stability could be maintained and adequate numbers assured for each industry and occupation. Within each sphere of production, however, individuals by and large were independent and their activities only loosely coordinated, if at all...This type of organization could produce high standards of quality and workmanship but was limited quantitavely to low levels of output per head.

The capitalist system of production turned this structure on its head. The macro system become unconsciously structured, while the micro system became hierarchically structured." ("The Multinational Corporation and the Law of Uneven Development," in Hugo Radice, ed., International Firms and Modern Imperialism, Harmondsworth, 1975, p.41).

More cryptically, John Nef provided a similar description: "Medieval Europe at its best was an approach to unity in diversity; the modern civilization which has taken possession of the globe during the past hundred years is nearer disunity in standardization." (War and Human Progress, N.Y. 1968, p.5).

Despite corporatist optimism for the planning potential inherent in the micro level structures of society, the mulish problem nonetheless remained: "behavior which is rational for individual companies can lead and periodically must lead to irrational results for the economy as whole." (Ernest Mandel, Late Capitalism, pp.246-247).

20. Fascismo e capitalismo, Roma 1931, pp.133-135.
It is quite possible that such a program as Bottai indicates here - rather than being "the initiative of Italy in the world" - was significant influenced by contributions given to the August 1931 "World Social Economi Planning Conference", held in Amsterdam. The conference was organized by the International Industrial Relations Institute, founded in 1925, with its head office at The Hague, though in fact was administered from New York by Mary L. Fledderus and M. van Kleeck. As in the case of an earlier international congress held in Cambridge (U.K.) in 1928, the Amsterdam meeting brought together both western and Soviet industrial reformers, socialists, syndicalists and Taylorites, among whom were Henri de Man; the subsequent New Deal activist Lewis Lorin; as well as the president of the Taylor Society, Harlow S. Person. Person's contribution, in particular, had made a considerable impact, and the work of the congress as a whole was studiously monitored by the "Osservatorio economico" annexed to the Scuola di scienze corporative in Pisa, under the overall authority of Giuseppe Bottai.
Of course, this congress took place in the context of the world depression. However, from the point of view of the reformist intervention discussed in this thesis, the disaster of the 1930s only served to highlight, or indeed confirm, an analysis that had been evolving in industrial reform circles for more than two decades.
In Person's discourse, it was pointed out that the "periodic disfunction of industrial processes" was due to the fundamental contradiction between the profit imperative of the individual capitalist firm and the opposing tendency of cooperative integration that was an inherent feature of modern production processes: "...new principles of organizatio and control have been elaborated and applied by individual firms and integrated groups of companies," Person reported; "and if these were applied to the organization and control of industrial society conceived as an organic whole, many and perhaps the greatest part of the forces that cause periodic disfunctions...in industrial life now would be eliminated.. Fifty years ago scientific management began with the problem of the individual job, but in order to put it under control it was compelled, almost simultaneously, to stabilize all the connected jobs; that is, the entire shop. Then, to complete the stability of the shop(production), it had to face the problem of commerce and sales. The stabilization of relations between production and sales demonstrated the need to stabilize the function of coordination, general administration. All this for the individual firm, beyond which scientific management has not yet had notable influence.
Now, however, it is being realized that the complete stabilization of an individual firm by itself is not possible; that the whole of industry of which it is a part must be stabilized - and probable all the industries of a nation in their relations, as well as industrial and commercial relations on an international level." (quoted in Alfredo Salsano, "Gli ingegneri e il socialismo. Taylorismo e planismo di fronte alla grande crisi," Enzo Collotti, ed., L'internazionale operaia e socialista tra le due guerre, Fondazione Giangiacomo Feltrinelli, annali, anno 23, 1983-84, Milano, 1985, pp.1183-1188.).

21. "La XVII Sessione della conferenza Internazionale del lavoro," Gerarchia, July 1933 - XI,n.7, p.559.

22. ibid.

23. Camillo Pellizzi, Una rivoluzione mancata, Milano 1949, pp.9-10.

24. ibid., p.26.

25. ibid. pp.38-40.

26. Logica della Corporazione, Roma 1934, p.42.

27. "Il Secondo Congresso nazionale degli ingegneri italiani," L'industria , vol. XLV, n. 10, 31 May, 1931, p.251.

28. Bottai, Fascismo e capitalismo, p.26.

29. The Engineers and the Price system, pp.66-72-79.

Footnotes. Technology Transfer, Factor Availability and the State. Giuseppe Belluzzo and the Engineers' Critique.

1. This, of course is only one angle from which to approach the roots of the profound problem, still very much felt in Italy, of clientelism and the private use of public power to control scarse resources, which inspired much corporatist rhetoric but which, in practice, was greatly strengthened by the fascist regime.

2. "La trasmissione elettrica della forza e il suo significato per l'avvenire dell'industria italiana," La Perserveranza, 21 April, 1890, originally read to the Circolo Filologico of Milan, in Colombo, Industria e Politica, p. 351.

3. A. Bocciardo and G. Falck, "La ghisa, i combustibili e l'energia elettrica," Politecnico, a. LXXIV, 1926, p.344.

4. ibid.

5. ibid., p.345.

6. ibid.

7. R.A. Webster, Industrial Imperialism in Italy, 1908-1915, Berkeley, L.A., 1975, p.13.
The enormously complex problem of trade policy in technology importing countries is still far from being amenable to a unitary solution. Martin Fransman posed the question directly in 1984: "can technological capabilities be enhanced under conditions of protection? The answer to this question...must be in the affirmative, although it is perhaps worth stressing that (improvements in total factor productivities) will not necessarily occur...It may be concluded that technological capabilities may be enhanced under conditions of protection, although it does not follow from this either that (a) protection is always needed for the development of technological capability, or (b) that the granting of protection will necessarily be followed by improved technological capabilities...we have seen that the experience of many of the newly industrialised countries with regard to trade in goods and technology and the enhancement of technological capabilities, is far more complex than any strict dichotomy between free trade and protection or between export-orientation and import-substitution suggests." "Technological Capability in the Third world: An Overview and Introduction to some of the Issues Raised in this Book," in Technological Capability in the Third World, London, 1984, pp.20-21.
Frances Stewart essentially agreed with this assessment, further complicating the question, however, by considering the problem of the precise type of innovation that protectionism may or may not encourage: "In the very early stages of development, protection/import substitution is a necessary condition (in most cases) of production...But while it is necessary, it is not sufficient. It is quite possible - and indeed is often observed - that production takes place behind a heavy protective barrier on the basis of imported technology with no local technological change...it seems plausible to hypothesise that local product innovation will occur more often behind protective barriers, while the export-oriented economies will tend to take product design from their main

developed country markets. On the other hand, process innovation (reduced costs, greater labour intensity) may be more likely under the pressure of international competition and endowment reflecting factor prices."

In any case, and perhaps most importantly,"the appropriate policy depends in part on the type of local technology it is intended to promote.

"Three types may be contrasted. First, a strong 'appropriate' technology orientation may suggest exclusion of most advanced capital-intensive technology and inappropriate products. Hence the technology imported will be only that necessary to help develop local appropriate technology. Second, countries may wish to adapt foreign technology to local conditions, and to use foreign technology to learn to produce it for themselves...Third, the aim may be to master the most advanced technologies. Here restrictions on technology imports may be mild and take second place to the aim of technological mastery." "Facilitating Indigenous Technical Change in Third World Countries," in Fransman, ibid., pp.82-84.

It is difficult to slot the Italian experience into this typology, primarily because of the dualist nature of Italian economic development. The South remained and remains today technologically primitive, and such development that did take place in the North in capital intensive industry was not accompanied by investment in external economies, and intensified the dualist aspect of economic development. Pre-industrial patterns of clientelistic methods of resource allocation were decisive in this regard, and introduce a complicated new variable into the problem of trade policy and technology transfer.

8. Unfortunately, no-one has yet written study of this astonishingly active individual, whose career belies any attempt to maintain any sort of rigid, categorical separation between modern engineering, corporate business, and political reformism. the only biographical information that seems to be available on Belluzzo is in the Dizionario Biografico degli Italiani.

9. All biographical information from the Dizionario Biografico degli Italiani, pp.14-16.

10. "La produzione italiana e la scienza," Economia Fascista, Roma, 1928, pp.53-54.

11. Consciousness of "proletarian" status among nations in Italian reform circles was if anything significantly intensified in the 1920s. Reporting in May 1927 on Louis Loucheur's proposal to hold an International Economic Congerence - to establish cooperative arrangements in the international organization of production and thus remove the causes of future war - one Italian writer noted: "The picture is doubtless grand. As far as Italy is concerned, however, it must be said immediately that it is incomplete, because the two fundamental problems of the Italian economy have not been considered: overpopulation and the dearth of raw materials." Given the factor endowment advantages of other countries, such conferences could only serve as "instruments of political domination." With no indigenous coal or iron deposits, and population growth at a rate of 400,000/year (and emigration closed off) Italy's population problems were thus distinct from every other country in Europe. In France, by contrast, zero population growth and the annexation of Alsace-Lorraine and its mineral deposits, could only lead to the conclusion that French protectionism was merely "combattive", "a means to defend the expansion of power, not simply an elementary problem of life."

The source of German strength was different, but nonetheless worked to Italian disadvantage. First, German heavy industry had been recontructed

with foreign loans, then, in the international iron cartel agreements of 1927, was assigned larger production quotas than any other participant. An externally financed, efficient industrial structure did not, therefore, require a protective trade policy, but the threat of cheap German goods flooding European markets was if anything starker than French economic nationalism. In any case, the organization of production in Italy had already been technologically defined along the general lines followed by its competitors, without, however, enjoying their endowments, and post-war economic trends had not fundamentally altered Italy's position as "proletarian" in the international division of labour. Virginio Gayda, "The International Economic Conference and Italy: Peace or Economic War," Rivista d'Italia e D'Americaa.V, Maggio, 1927, 267-272.

12. "Missione sociale e politica dell'A.E.I.," L'Elettrotecnica, vol. VI, n. 23, August, 1919, p.479.

13. "La organizzazione scientifica delle industrie meccaniche in Italia," Bollettino del Comitato Centrale di Mobilitazione Industriale, n.16, Oct. 1918, p.352.

14. ibid.

15. Sergio Romano, Giuseppe Volpi. Industria e finanza tra Giolitti e Mussolini, Milano, 1979, p.31.

16. "Le industrie di guerra," L'industria, XXXIX, n.1, 15 January, 1925, p.5.

17. ibid.

18. Romano, Industria e finanza, p.32.

Footnotes. Technology Transfer, Indigenous Capability and Industrial clientelism in Italian Development

1. Peaceful Conquest. The Industrialization of Europe, 1760-1970, Oxford, 1982, p.85.

2. Nathan Rosenberg, "The international transfer of technology: implications for the industrialized countries," Inside the Black Box. Technology and Economics, Cambridge, Mass., 1982, p.246.

3. ibid., p.249.

4. ibid.

5. Roberto Maiocchi, "Il ruolo delle scienze nello sviluppo industriale italiano," in Storia d'Italia, annali 3, Scienza e tecnica nella cultura e nella società dal Rinasciamento a Oggi, a cura di Gianni Micheli, Einaudi Torino, 1980, p.886.

6. Silvio Leonardi, Le macchine utensili e la loro industria. Alternative tecnologiche nello sviluppo economico, Milano, 1961, p.54.

7. ibid.

8. Maiocchi, "Il ruolo delle scienze," p.895.

9. 4,000,000 lire/year being the value of domestic production, as against 18,000,000 lire/year in imports. ibid., p.54.

10. ibid., p.55.

11. Richard B. Du Boff, "The Introduction of Electric Power in American Manufacturing," Economic History Review, December, 1967, p.509.

12. ibid., p.512.

13. ibid., p.514.

14. ibid., p.518.

15. ibid., p.517.

16. Letter published as an appendix, to J.F.C. Snell, "Application of Electricity to Industrial Purposes," Transactions of the North-east Coast Institution of Shipbuilders and Engineers, vol. 21, 25 Feb., 1905, p.176.

17. Harry Jerome, Mechanization in Industry, National Bureau of Economic Research, N.Y., 1934, p.46.

18. Du Boff, "The application of Electricity," p.513.

19. Renato Giannetti, La Conquista della forza. Risorse, tecnologia, ed economia nell'industria elettrica italiana, 1883-1940, Milano, 1985, p.161.

20. ibid.

21. ibid.

22. Jerome, Mechanization in Industry, p.258.

23. Giannetti, La Conquista della forza, p.163.

24. ibid., p.165.

25. ibid.

26. Jerome, Mechanization in Industry, p.289.

27. Valerio Castronovo, L'industria italiana dall'Ottocento a oggi, Mondadori, 1982, p.108.

28. Franco Bonelli, Lo sviluppo di una grande impresa in Italia. La Terni dal 1884 al 1962, Torino, 1975, p.7.

29. ibid., p.23.

30. ibid., p.90.

31. ibid., pp.101-102.

32. Arturo Paoloni, "Il problema italiano dei metalli leggeri," L'industria, XXXIX, n.20, 31 Oct., 1925, p.530.

33. All biographical information on Bocciardo from the Dizionario Biografico degli Italiani.

34. Bonelli, Terni, p.128.

35. ibid., pp.132-133.

36. ibid., p.157.

37. ibid., p.160.

38. ibid., p.153.

39. ibid., p.158.

40. ibid., p.166.

41. Domenico Preti, "La politica agraria del fascismo: note introduttive," in Economia e Istituzioni nello state fascista, Riuniti, 1980, p.73.

42. ibid., p.85.

43. ibid., pp.16-17.

Footnotes. Science-based production in the clientelistic state: the chemical industry and notes on the rise of Montecatini

1. "L'istituto scientifico tecnico Ernesto Breda," Ingegneria Italiana, n.30, 11 July, 1918, p.23.

2. "Le industrie di guerra," L'industria, XXXIX, n.1, 15 Jan., 1925, p.5.

3. Roberto Maiocchi, "Il ruolo delle scienze," p.880.

4. quoted in ibid., p.883, fn.

5. ibid., p.892.

6. ibid., p.891.

7. Guglielmo Koerner, "L'industria chimica in Italia nel cinquantennio 1861-1910," in Cinquanta anni di storia italiana, vol. 1, Milano, 1911, p.56.
   Perhaps more than any other industrial sector, a fully developed chemical industry presupposed a vast network of mutually interdependent technological relationships. In the period before rayon (or simply artificial fibres) entered the international economy after world war I, industrial chemistry was largely defined by the fruits of two basic processes - the solvay method of alkali (ammonia soda) manufacture, and the synthesis of organic compounds for dyestuffs. The intricacies, complexities and ramifications of the revolution effected by the new ammonia soda process and dyestuffs are detailed in David Landes, The Unbound Prometheus, Cambridge, 1981; Luigi Gasperini, ed., L'industria chimica nella storia italiana, Messina-Firenze, 1974; and L.F. Haber, The Chemical Industry, 1900-1930, Oxford, 1971.

8. Alberto Battarra, Le fabbriche di prodotti chimici, Torino, 1924, pp.13-15.

9. Koerner, "L'industria chimica," p.12.

10. ibid.

11. ibid., p.4.

12. Battarra, Le fabbriche, p.15.

13. ibid.

14. By no means a spent complaint by Italian industrialists. Cf. "Questo stato vecchio e debole," La Repubblica, 5 June, 1987, by Luigi Lucchini, present day president of Confindustria.

15. "Le industrie di guerra," p.3.

16. Koerner, "L'industria chimica," pp.2-3.

17. Luigi Gasperini, ed., L'industria chimica nella storia italiana, pp.40-41.

18. ibid., p.43.

19. ibid., p.46.

20. ibid.

21. ibid., p.48.

22. Noble, America by Design, p.15.

23. Gasperini, L'industria chimica, p.50.

24. ibid., pp.76-79.

25. ibid., p.79.

26. ibid., p.80.

27. Organizzazione scientifica del lavoro, a. III, 2 Nov., 1928, p.702.

28. Bollettino della Proprietà Intellettuale, a.XXVI, fasc. 3-4, parte II, 1927, p.125.

29. ibid., pp.125-131.

30. "L'industria tedesca e la guerra," Ingegneria Italiana, vol.II, n.35, 22 Aug., 1918, p.97.

31. Noble, America by Design, p.16.

32. "Il comitato nazionale scientifico-tecnico per lo sviluppo e l'incremento dell'industria italiana," Atti del III Congresso Internazionale dell' Organizzazione Scientifica del lavoro, Roma, 1927, p.1024. A precise breakdown of what was seized by the Italian authorities is not indicated in this source.

33. Gasperini, L'industria chimica, p.76.

34. G. Baglioni, L'ideologia della borghesia industriale nell'Italia liberale, Torino, 1974, p.115, quoted in Carlo Tullio-Altan, La Nostra Italia. Arretratezza socioculturale, clientelismo, trasformismo e ribellismo dall' Unità ad oggi, Milano, 1986, p.83.

35. ibid.

Footnotes. The Breaking of the Chain. Non-Innovation and the Failed Revolution in Social Production

I. Introduction: The Problem of Management and the "Anti-Industrial Spirit"

1. "L'industria chimica in Italia nel cinquantennio 1861-1910," in Cinquanta anni di storia italiana, vol. 1, Milano 1911, p.4

2. Battarra, Le fabbriche di prodotti chimici, p.47.

3. Anthony Brewer, Marxist Theories of Imperialism. A Critical Survey, London, 1980, p.248.

4. Ian Benson and John Lloyd, New Technology and Industrial Change. The Impact of the Scientific-Technical Revolution on Labour and Industry, London, 1983, p.107.

5. Anne Carter, Structural Change in the American Economy, Cambridge, Mass., 1970, p.33, quoted in Rosenberg, "Technological Interdependence in the American Economy," p.72.

6. Mechanization in Industry, pp.179-180-190.

7. Noble, America by Design, p.xix.

8. Arthur H. Cole, "The Entrepreneur: Introductory Remarks," American Economic Review, 58, May 1968, 61-62, quoted in Oliver E. Williamson, "Emergence of the Visible Hand: Implications for Industrial Organization," in Chandler and Daems, Managerial Hierarchies, p.183.

9. Walter Meakin, The New Industrial Revolution, London, 1928, p.25.

10. Giulio Scagnetti, Gli Enti di privilegio nell'economia corporativa italiana, Milano, 1942.

11. Martin Kitchen, Fascism, London and Basingstoke, 1983, p.50. Beneduce was a collaborator with Francesco Nitti in organizing the Istituto Nazionale delle Assicurazioni in 1912, and subsequently with Bonaldo Stringher, president of the Bank of Italy, in founding the Consorzio per sovvenzioni suivalori industriali, to help subsidise industrial investment. Following the war, he was president of the Commissione Finanze e Tesoro, then minister of Labour in the Bonomi government of 1921. His most important work, however, was carried out in public and private financial initiatives undertaken as president of the Societa per le strade ferrate meridionali, the so-called "Bastogi" from 1926, which made him one of the major protagonists in the financial operations which carried the electrical industry to a position of prime importance in the inter-war I talian economy. On Beneduce, see the Dizionario Biografico degli Italiani, pp.455-466, and Castronovo, L'industria italiana dall'Ottocento a oggi, p.197.
Menichella had been liquidator of the Banca Italiana di Sconto, controlled by the Perrone brothers' Ansaldo, which collapsed after the war because of overcapitalization and the end of military demand. Menichella had also been director general of the Societa Finanziaria Italiana, a holding company of Credito Italiano. Castronovo, op.cit.

12. Scagnetti, Gli Enti di privelegio, p.24.

13. ibid., p.69.

14. L'Eletttotecnica, vol. VIII, n.12, 25 April, 1921, pp.263-267.
Three years later, at the Aprill924 unveiling of a sculptured bust of Giuseppe Colombo at the Edison Building in Milan, Corbino read a memorial speech, which was printed in the 15 April,1924 issue of L'Elettrotecnica. At that time Corbino was minister of National Economy in the fascist government, and the editors prefaced the article with the following statement: "One of the most interesting features of the minister of National Economy is that of being simultaneously a great physicist and a profound student of economic and political science, which enables him to pass indifferently from treating the most abstruse problems of physics to the highest questions of finance in industry and commerce." (vol. XI, n.11, p.236.). Along with Guglielmo Marconi, Francesco Mauro (after 1926 editor , with Gino Olivetti, of the journal L'organizzazione scientifica del lavoro, and president of the International Scientific Management Association), Corbino had also been appointed to the Consiglio Superiore dei Lavori Pubblici formed in February 1923. Indeed, he was president of this technical body, one of the first to be reformed after the fascist march on Rome, and which was the technical and decision making core of the Department of Public Works. (L'Elettrotecnica, vol. X, March, 1923, pp.169-170.).

15. "Lo spirito anti-industriale," p.263.

16. ibid.

17. ibid.

18. ibid.

19. ibid.

20. ibid.

21. ibid.

22. ibid., p.264.

23. ibid.

24. ibid.

25. ibid.

26. ibid., p.265.

27. ibid.

28. ibid.

29. ibid.

30. ibid., p.267.

Footnotes. The Problem of Indigenous Financing

1. R.A. Webster, Industrial Imperialism in Italy, 1908-1915, p.6.
2. Colombo, Industria e Politica, p.52.
3. "Il ruolo delle scienze," p.897.
4. ibid.
5. Giangiacomo Migone, Gli Stati Uniti e il Fascismo. Alle origini dell'egemonia americana in Italia, Milano, 1980, especially pp.151-178.
6. L'Elettrotecnica, XII, n.17, 15 June 1925, p.424.
7. L'Elettrotecnica, XIII, n.8, 15 March 1926, p.169.
8. Bignami was also president of the engineering association, the Federazione fra i Sodalizi fra gli ingegneri ed Architetti italiani, which in December 1919 had gathered together the engineers elected to the Chamber of Deputies to form the Gruppo Parlamentare degli Ingegneri, a corporatist group of engineer-politicians which cut across party political allegiances. At that time sitting in the Chamber of Deputies there were 10 Constitutionalist engineers adhering to the group (among whom was Bignami); 3 Socialists; 3 Popolari; 2 Republicans; 1 Reformist; and 1 "combattente". (Ingegneria Italiana, n. 102, 18 Dec. 1919, p.349.).
   In addition, Bignami served as president, in the mid-192os, of the "Comitato autonomo perl'esame delle invenzioni", part of whose work will be referred to in more detail later.
9. Renato Giannetti, La conquista della forza, pp. 92-93.
10. Jon S. Cohen, "Italy 1861-1914," in Rondo Cameron, ed., Banking and Economic Development, N.Y. 1972, p.73.
11. ibid., p.75.
12. ibid., p.81.
13. ibid., p.83.
14. Ministero dell'Economia nazionale, Atti del Consiglio Superiore dell' economia nazionale, sessione prima, June 1924, Roma 1925.

Footnotes. The Non-Integration of the Power Supply Network

1. J.F.C. Snell, "The Application of Electricity to Industrial Purposes," Transactions of the North-East coast Institution of Shipbuilders and Engineers, vol. 21, 25 Feb., 1905, p.158.

2. ibid.; Renato Giannetti, La conquista della forza, p.56.

3. ibid.

4. ibid., pp.9-10.

5. ibid., pp.10-11.

6. "Il trasporto razionale dell'energia di supero," Atti del consiglio superiore dell'economia nazionale, 4 Feb., 1926, sezione 2, Roma 1927.

As an important figure in business and technical reform circles in the first decade of fascist rule, Semenza warrants consideration in his own right, his reformist efforts lauded by no less an individual than Ettore Conti of Edison on Semenza's death in December 1929. (L'Elettrotecnica, XVI, 36, 25 Dec. 1929, p.845).

Born in London in 1868, Semenza returned to Italy to study electrical engineering at Colombo's Milan Polytechnic, graduating in 1893. Following his studies Semenza went to work for Edison, where as engineer and manager he planned and organized the construction of the isolator at Paderno. Leaving Edison in 1913, Semenza began working as an engineering consultant, specializing in telephone systems. During the war he took part in government work as president of the Commission for Shell Testing (Comissione di collaudo dei proiettili) and was also president of the Italian Association of Electrical Engineers from 1915 to 1918. In his capacity as president of the electrical engineers' association, Semenza was responsible for ordering the compilation of all statistics relating to electrical equipment in operation, the first volume of which appeared in 1927. Before Semenza's intervention so such statistical information existed as general reference material for Italian engineers.

His work as president of the engineering association during the war also included determining norms for testing electrical equipment (established in Italy for the first time in 1917), examining alternatives for patent reform, and the Association under Semenza's guidance collected and submitted material to the government on hydro potential in Italian rivers, and suggested guidelines to follow in the formulation of tariff policy.(ibid.).

In 1918 Semenza became president of the Comitato Nazionale Scientifico-tecnico (whose work has already been mentioned in connection with technology appropriation from German industry as part of the Versailles reparations agreements), a position he held until 1928 when the Comitato passed under the authority of the Consiglio nazionale delle Ricerche. A year later Semenza was nominated member of the second section of the technical decision making body of the Ministry of Public Works, the Consiglio dei Lavori Pubblici, the second section of which was charged with the problem of electric traction.

Semenza's career also included interventions at an international level. As Italian secretary of the American Institute of Electrical Engineers, he was in continuous contact with the dominant representative of this sector in the United States, and from 1923 he was president of the International Electrical Engineering Commission. The Commission

had been formed on the initiative of Colonel Crompton in 1906, and under its auspices international specifications were determined for electrical machinery, alternators, motors, generators, traction equipment, resistance temperatures, standards of lamp testing, and so on According to Conti's eulogy of Semenza in the pages of L'Elettrotecnica, Semenza had to suffer criticism as head of the international engineering Association for his basic failure to have the British and Americans convert to the metric system, but defended him by pointing out the absolute novelty of electrical technology during Semenza's most active period, and that gaining cooperation at the international level in the formulation of standards for such a complex technology would require considerable time and effort. (ibid.).

Finally, Semenza was also president of the National Association for the Prevention of Work Injuries (Associazione nazionale per la prevenzio degli infortuni sul lavoro), a type of workmen's compensation board duri the fascist period. (L'industria, 15 FEb., 1927, vol. XLI, n.3, p.78.

7. "Il trasporto razionale dell'energia elettrica," p.41.

8. ibid., p.42; Domenico Civita, "L'organizzazione scientifica nell' industria elettrica," L'organizzazione scientifica del lavoro, a.II, n.6, Dec. 1927, p.449.

9. Semenza, "Il trasporto razionale," p.42; Civita, "L'organizzazione scientifica," p.449.

10. G. Vallauri, "Elettricita ed Energia," L'Elettrotecnica, XVII, n.31, 5 Nov., 1930, p.710. Paper read to the World Energy conference in Berli June 1930.

11. Domenico Civita, "Note economiche e finanziarie," L'Elettrotecnica, vol. IX, April, 1922, p.258.

12. "Economia moderna dell'energia," Politecnico, August, 1925, p.241.

13. Giannetti, La conquista della forza, p.76.

14. ibid., p.77.

15. ibid., p.80.

16. ibid., p.82.

17. Romano, Giuseppe Volpi. Industria e finanza tra Giolitti e Mussolini, p. 84.

18. ibid.

19. ibid., p.85.

20. Civita, "Note economiche e finanziarie," op.cit., p.259.

21. Consumption increased 165% during this period. ibid., p.258.

22. Romano, Giuseppe Volpi, p.92.

23. Giannetti, La conquista della forza, p.57.

24. Civita, "Note economiche e finanziarie," op.cit.,p.258.

25. ibid., p.259.

26. In the United States, by contrast, the problem of an integrated power network had been dealt with in 1919 by the Superpower Commission, which had been charged with rationalizing the system of energy supply for the eastern industrial states. Seven power centrals were constructed, and operated as a single electricity network at 110 volts. (Giannetti, La conquista della forza, p.85.).

27. Gianni Toniolo, L'economia dell'Italia fascista, Bari, 1980, pp.31-34.

28. ibid.

29. ibid., p.46.

30. ibid., p.47.

31. Semenza, "Il trasporto razionale dell'energia elettrica," p.55.

32. Civita, "Note economiche e finanziarie," op.cit., p.258.

33. Civita, L'organizzazione scientifica nell'industria elettrica," op. cit., p.451.

34. Semenza, "Il trasporto razionale dell'energia elettrica," p.58.

35. Giannetti, La conquista della forza, p.149.

36. ibid., p.151.

37. Arturo Paoloni, "Il problema italiano dei metalli leggeri," L'industria XXXIX, n.20, 31 Oct. 1925, p.531.

38. ibid.

39. ibid.

40. Giannetti, La conquista della forza, p.154.

41. ibid.

42. Civita, "L'organizzazione scientifica nell'industria elettrica," p.451.

43. Domenico Preti, Economia e istituzioni nello state fascista, Riuniti, 1980, pp.115-116.

44. Giannetti, La conquista della forza, p.160.

Footnotes. Transportation and communications in Inter-War Italy

1. Marco Semenza, "Le arti di utilizzare il tempo nelle industrie e nei servizi pubblici," L'Elettrotecnica, March 1923, vol. X, n.7, p.137.
2. ibid.
3. ibid.
4. ibid.
5. ibid., p.138.
6. ibid.
7. ibid.
8. ibid.
9. Patrick O'Brien, The New Economic History of the Railways, London, 1977, pp.20-21.
10. Comment by Pirelli on Targetti's report, "Il problema delle tariffe ferroviarie per l'esportazione," Atti del Consiglio Superiore dell' Economia nazionale, sessione V, Nov. 1926, Roma 1927, p.157.
11. ibid.
12. Luigi Luiggi, "L'elettrificazione delle ferrovie italiane dello state," Rivista delle comunicazioni, a. I, n.3, Feb. 1925, pp.8-9.
    The author of this article was president of the Rome Scientific management congress of 1927, as well as the Italian representative of the American society of Civil Engineers.
13. L'Elettrotecnica, XI, n.2, 15 April, 1924, p.255.
14. Filippo Tajani, Storia delle ferrovie italiane, Milano, 1939, p.178.
15. ibid., pp.179-180.
16. ibid., p.153; "L'elettrificazione delle ferrovie italiane," Politecnic 1922, pp.50-51.
17. ibid.
18. "La trazione elettrica ferroviaria in Italia e all'estero," L'Elettro- tecnica, February, 1924, pp.95-99.
19. ibid., p.96.
20. ibid., pp.97-98.
21. ibid.
22. ibid., p.98.

23. Ingegneria Italiana, n.116, April, 1920, p.216.

24. ibid.

25. Tajani, Storia delle ferrovie italiane, p.181.

26. ibid., p.182.

27. ibid.; Pietro Lanino, "Ferrovia ed automobile. Concorrenza e coordinamento," Rivista tecnica delle ferrovie italiane, a.XVII, vol. XXXIII, n. 5, 15 May, 1928, p.231.

28. Tajani, Storia delle ferrovie italiane, p.245.

29. ibid.; Lanino, "Ferrovia ed automobile," p.220.

30. Lanino, ibid., p.216.

31. ibid.

32. ibid., p.221.

33. ibid., p.231.

34. ibid., p.228.

35. Ingegneria Italiana, n.56, 23 Jan. 1919, p.62.

36. Lanino, "Ferrovia ed automobile," p.228.

37. ibid., pp.232-233.

38. Costanzo Ciano, "L'azienda delle ferrovie italiane dello stato," Annali di Economia, vol. IX, n.2, June 1934, p.512.

39. Costanzo Ciano, Dal Regno all'Impero, n.d., p.399+ "Congresso dell' Associazione Elettrotecnica Italiana", speech of minister of the Posts, Giuffrida; L'Elettrotecnica, vol. IX, n.26, Aug. 1922, p.590.

40. Ministero delle Poste e delle Comunicazioni. Ispettorato generale delle telecomunicazioni, L'azienda di stato per i servizi telefonici dalla sua costituzione, 1925-1955, Roma 1955; "XXIV Riunione dell' A.E.I., Trieste, 30 Oct - 4 Nov., 1919," L'Elettrotecnica, vol. VII, 25 May, 1920, p.277.

41. Livio Ciardi, "I trasporti e l'ordinamento corporativo," Archivio di Studi corporativi, vol. II, 1931-IX, pp.384-387.

42. Scipione R. Treves, "L'organizzazione scientifica dei servizi nelle società elettriche e telefoniche, come organizzazione funzionale gerarchica," Atti del III Congresso dell'organizzazione scientifica del lavoro, Roma 1927, p.469.

43. ibid., p.470.

44. "XXIV Riunione dell'A.E.I.," pp.278-279.

45. Semenza, "Le arti di utilizzare," p. 138.

Footnotes. The Standardization Movement

1. Giuseppe Belluzzo, "Le industrie di guerra," L'industria, XXXIX, n.1, 15 Jan. 1925, p.6.
2. ibid.
3. Ingegneria Italiana, n.80, 10 July, 1919, p.25.
4. L'industria, XXXVII, 14, 13 July, 1923, p.275.
5. "Il problema dell'unificazione in Italia ed all'estero (standardizzazio standardisation) - aspetti tecnici e ripercussioni economiche," L'industria, XXXIV, 1920, pp.103-105.
6. ibid., 103.
7. ibid., p.105.
8. ibid.
9. ibid.
10. "Per un'industria italiana del materiale didattico e scientifico," L'Elettrotecnica, vol. VI, n.8, 15 March 1919, pp.150-152.
    Bordoni was born in Rome in 1884, where he graduated in electrical engineering from the Istituto Tecnico Leonardo Da Vinci. His primary technical interest was in the technology of industrial workplace illumination, and in 1935 his work on the subject, Le misure di illuminazione negli ambienti di lavoro, was published. Before the war he also worked in close association with the engineer-reformers Angelo Barbagelata and Giancarlo Vallauri, a collaboration which resulted in the founding of the journal L'Elettronica in 1914, on whose editorial board Bordoni sat.
    At the outbreak of the war Bordoni enlisted, was promoted to captain, and worked at the under-secretariat of arms and munitions in the offices of the Central Committee for Industrial Mobilization.
11. "Per un'industria italiana," p.150.
12. ibid.
13. ibid.
14. ibid., p.151.
15. ibid.
16. ibid., p.152.
17. ibid.
18. ibid.

19. Carlo Rossi, "L'Unificazione," Atti del XIII convegno Nazionale degli Ingegneri Italiani, Milano, 17-20 June, 1962, vol. I. L'Ingegneria nei primi cento anni dell'Unità d'Italia.

20. ibid., p.36.

21. ibid., p.37.

22. ibid., p.36.

23. "L'unificazione nell'industria meccanica in Italia," L'industria, XXXVII, 1923, p.56.

24. Rossi, "L'Unificazione," p.36.

25. "L'unificazione nell'industria meccanica," p.56.

26. Rossi, "L'unificazione," p. 37.

27. L'Elettrotecnica, XI, n.4, 5 February, 1924, p.87.
This contract involved the sales of 25 Kilometers of trifase cable for tensions of 27,000 and 46,000 volts.(ibid.).

28. ibid.

29. L'Elettrotecnica, XI, 15 Jan. 1924, n.2, p.65.

30. ibid.

31. ibid.

32. Domenico Civita, "L'organizzazione scientifica nell'industria elettrica L'organizzazione scientifica del lavoro, a. II, n.6, Dec. 1927, p.451.

33. ibid., p.452.

34. ibid.

35. ibid., p.453.

36. ibid., p.454.

37. L. Lombardi, "Il 'Bureau of Standards' degli Stati Uniti," L'Elettrotecnica, vol. XIII, Nov. 1926, p.711.

38. ibid.

39. ibid.

40. "L'unificazione nell'industria meccanica in Italia," p.56.

41. ibid.

42. Rossi, "L'unificazione," p.37.

43. The organization set up to ensure military preparedness in inter-war Italy, under the authority of General Alfredo Dallolio, who had been in charge of the war-time Armaments Ministry.

44. "Insediamento dell'Ente nazionale per la unificazione dell'industria," L'industria, XLV, n.5, 15 March 1931, p.110.

45. ibid.

46. ibid., p.109.

47. ibid.

48. ibid.

49. ibid., p.112.

50. ibid., p.110.

51. ibid., p.112.

52. ibid.

53. ibid., p.113.

54. ibid., p.115.

55. Rossi, "L'unificazione," p.36.

56. ibid., pp.35-36.

Footnotes. "Americanismo"and the Critique of Industrial Organization

1. Ingegneria Italiana, n.111, 26 February 1920, p.136.
2. "Note per la commissione del dopoguerra. S.H. Com. Produzione Industriale. Gruppo Organizzazione Industriale", Ingegneria Italiana, 10 October, 1918, n. 42, pp.216-218.
3. ibid., p.217.
4. ibid.
5. ibid.
6. "Per la futura organizzazione industriale italiana: progetto generale di organizzazione industriale secondo i principi piu moderni," L'industria, XXXIII, 15 Jan. 1919, pp. 35-37.
7. ibid., p.35.
8. Giuseppe Belluzzo, "Le industrie di guerra," L'industria, XXXIX, n.1, 15 Jan. 1925, p.3.
9. ibid.
10. ibid.
11. Malerba, "Per la futura organizzazione industriale," p. 36.
12. ibid.
13. ibid., p.37.
14. Luciano Segreto, "Armi e munizioni. Lo sforzo bellico tra speculazione e progresso tecnico," Italia Contemporanea, n.146-147, 1982, pp.35-36.
15. Ingegneria Italiana, n.34, 8 August, 1918, p.89.
16. Vito Volterra, "La Conferenza interalleata sulla organizzazione scientifica," Intesa Intellettuale, a. 1, n.4, 1918, pp.218-230.
17. ibid., p.219.
18. ibid., p.218.
19. ibid., p.226.
20. Pietro Lanino, "Note per la commissione del dopoguerra: Sottocommission Produzione Industriale - Gruppo Organizzazione Industriale," Ingegneria Italiana, nos. 43-44-45, 17 Oct. 1918, pp.228-229; Oct. 1918, p.244; 31 Oct. 1918, pp.260-261.
21. Gualberto Gualerni, Industria e fascismo. Per una interpretazione dello sviluppo economico italiano tra le due guerre. Milano, 1976, pp.69-70.
22. Ingegneria Italiana, 17 Oct. 1918, p.228.

23. Giuseppe Belluzzo, "Il convegno degli industriali italiani a Roma," L'industria, XXXVII, n.24, 31 Dec. 1923, p.53.

24. idid.

25. ibid.

26. Belluzzo quoted in Virgilio Dagnino, I cartelli industriali. Nazionali e Internazionali, Torino, 1928, p.134.

27. Virginio Gayda, "La lotta per il centesimo," Gerarchia, a.V, n.1,1926, p.455.

28. The implications of technological convergence for an intensification of industrial competition was expressed in the subsequent efforts of the Italian Standardization Institute to establish contacts with similar official bidies working abroad. At first the Institute's work concerned primarily domestically produced goods and services, but "contacts (with foreign standardization organizations) began to take place because of th simple fact that they found themselves studying the same problems at the same time." ("Insediamento dell'ente nazionale per la unificazione dell' industria," L'industria, XLV, n.5, 15 March 1931, p.64.).

29. G. Revessi, "L'avvenire industriale d'Italia e le idee di Davide Lubin," report to the Rome section of the Associazione Elettrotecnica Italiana, 10 January, 1919, in L'Elettrotecnica, vol. VI, n.8, 25 Jan., 1919, p.46-49.

30. ibid.

31. ibid.

32. ibid., p.47.

33. ibid., p.48

34. ibid.

35. ibid.

36. ibid.

37. ibid., p.49.

38. ibid., p.47.

39. ibid., p.48. On Wilson see Martin J. Sklar, "Woodrow Wilson and the Political Economy of United States Liberalism," in Martin J. Sklar, Ronald Radosh and Murray Rothbard, eds., A New History of Leviathan, N.Y., 1972: "(Wilson's) attitude corresponded with a world view that affirmed large-scale corporate-industrial capitalism as the natural and inevitable product of social evolution, and that regarded foreign investments and exports, defined in terms of industrial and finance capital, as indispensable to the nation's prosperity and social well-being. Beneficence at home and abroad, in this view, was a function of necessity. Large corporate production appeared as the vehicle of domest ic material progress; foreign economic expansion, considered a decisive condition of such production, promised to carry 'civilization', bourgeoi

liberal ideas and institutions, and a better way of life, to the agraria areas of the world, particularly as 'development' of natural resources i those areas was considered essential to such expansion.

It no more occurred to such liberals as Wilson than it did to the so-called Dollar Diplomatists before him, or than it does today to the 'internationalist'liberals, that investment in , and ownership by United States capitalists, constituted imperialism or exploitation... Open door expansion...appeared to them as simply the implementation of the natural international division of labor between the industrialized and agrarian nations; it meant mutually beneficial (and benevolent) business relationships and trade; it meant the assumption by the United States of its natural place in the world economy vis-a-vis the other industrial nations, by elimination of 'artificial' impediments to the operation of the laws of competitive commerce; it meant 'free trade'". Sklar, pp.58-59.

40. Giovanni Lume, "Fra Italia ed America," Rivista d'Italia e d'America, a.III, August 1925, p.29.

41. Ministero dell'Economia Nazionale. Atti del Consiglio Superiore, sessione III, February 4, 1926, p.14.

42. Benigno Crespi, "Economia corporativa fascista," Critica Fascista, VI, 24, 15 December, 1928, p.464.

43. Lello Gangemi, "La concentrazione e la razionalizzazione delle industrie in Italia," Archivio di Studi Corporativi, vol. I, 1930, p.555.

44. ibid., p.556.

45. ibid., p.559.

46. ibid., p.558.

47. ibid., p.560.

48. ibid., p.568.

49. ibid., pp.588-589.

50. Ministero dell'Economia Nazionale. Atti del Consiglio Superiore dell' Economia Nazionale. Riunione del 5 Feb., 1926, sessione III. Carlo Tarlarini, "Per un'organizzazione scientifica del lavoro e del commercio," pp.123-155.

51. Alessandro Giambitto, "L'organizzazione scientifica in Italia e L'insegnamento tecnico serale," Atti del III Congresso Internazionale dell'organizzazione scientifica del lavoro, Roma, 1927, p.458.

52. ibid.

53. ibid., p.459.

54. Tarlarini, "Per un'organizzazione scientifica," p.129.

55. ibid., p.126.

56. ibid., p.136.

57. ibid., p.123.

58. ibid., p.136.

59. ibid., p.133.

60. ibid., pp.136-137.

61. ibid., p.155.

62. In effect, this work would be localized and taken over by the Provincial Economic Councils, created on the 16th June 1927, essentially by simply changing the name of the former Chambers of Commerce. Organized under the overall authority of the Ministry of National Economy, these Councils were to perform the following functions: 1) observe local economic activity and collect data on regional production; 2) work with other local oraganizations to formulate initiatives to increase production and improve social and economic conditions in the province; 3) report fraud and any other offence in local manufacturing or agriculture to the Ministry; 4) take over work previously done by the Prefectures regarding laws pertaining to factory logos, designs and industrial prototypes; 5) receive and register plant modifications and factory closures; 6) release certificates for the transference of intermediate inputs; 7) form price lists in conformity with the Code of commerce; 8) formulate proposals to be submitted to the government on the development of the local economy; 9) formulate and propose reforms of the local education system to conform more closely to the requirements of local industry. ("Per l'istituzione degli uffici e consigli provinciali dell'economia," L'industria, XLI, n. 14, 31 July, 1927, pp.388-389.).

63. Giovanni Lume, "Fra Italia e America," Rivista d'Italia e d'America, a.III, August 1925, p.28.

64. Ettore Cardani, "Alleanza e cooperazione fra industrie," Politecnico, a.LXXVI, n.XI, Nov. 1928, p.615.

65. "La funzione creatrice dell'ingegnere consulente," Ingegneria Italiana, 10 Oct., 1918, p.215.

66. ibid.

67. Ingegneria Italiana, n. 50, 5 Dec., 1918, p.340.

68. "L'importanza del chimico nell'industria moderna," in Atti del LX Riunion SIPS, 1917, quoted in Roberto Maiocchi, "Il ruolo delle scienze nello sviluppo industriale italiano," op.cit. p.923.

69. "1919," L'industria, XXXIII, a.1, 15 Jan. 1919, p.2.

70. ibid.

71. ibid.

72. Ingegneria Italiana, n.31, 18 July, 1918, p.35.
In general, the role of the engineering community, and its contribution to the formulation of the evolving corporatist political model has not been explored in studies of Italy. Although the idea was not developed in historical analysis, Alexander De Grand, referring to an observation of the Italian sociologist Paolo Sylos Labini, pointed out

the importance of looking at the contribution of such social classes in the study of fascist corporatism:

> The intermediate élite groups - all those who have a managerial function in society, transmit orders or ideas, enforce discipline or organize services - are of vital importance for the study of Italian fascism... from 1900 to 1922 large numbers of middle-class intermediate elite groups responded to the pressures of unemployment and potential proletarianizat by using ideology as a weapon...as the Italian sociologist Paolo Sylos Labini has pointed out, intermediate élites are normally extremely conscious of their economic or social function. They envisage solidarity along vertical or hierarchical lines (loyalty to professions, institutio or careers rather than classes) which in the case of fascism led them to seek out corporative solutions to political problems. (Italian Fascis Its Origins and Development, Lincoln, Nebraska, 1982, pp.7-9.).

See also Edwin Layton, "Science, Business and the American Engineer", op,cit. p. 63; and "American Ideologies of Science and Engineering," op.cit., p.701:

> American enginers have been almost neurotically obsessed with status, and this has been especially true of consultants." ("Science, Business.. p. 63).

This is not, of course, a localized or national phenomenon, but an inherent feature of the engineer's mentality. The reason, however, to which engineers have always been deeply sensitive, and which is not necessarily generic in "intermediate élite groups", is because of the engineer's specific relationship with "business":

> The identification with business leaves the engineer in a marginal position. The merger of engineering with business is not an alliance between equals; on the contrary, the engineer's place is a subordinate one, defined by his position within the industrial hierarchy...One reaso for the persistent technocratic myth-making by engineers is that the dream of a society ruled by engineers offers a fantasy escape from bureaucratic subordination. ("Layton, "Science, Business and the Americ Engineer," pp.67-68.).

Layton, on the other hand, makes no connection with contemporary political phenomena.

Introduction: Military Production and Corporatism

Footnotes. War and Corporatism: The Organization of Mobilitazione Industriale

1. Giovanna Procacci, "Introduzione," Stato e classe operaia in Italia durante la prima guerra mondiale, Milano, 1983, p.13.

2. Pietro Lanino, "La grande industria nella guerra e nel dopo-guerra," Ingegneria Italiana, vol. IV, n.95, 30 Oct. 1919, p.225.

3. Giulio Scagnetti, Gli Enti di privilegio nell'economia corporativa italiana, Milano, 1942, pp.5-9.

4. ibid.

5. Procacci, "Introduzione," p.13.

6. Valerio Castronovo, L'industria italiana dall'Ottocento ad oggi, Torino, 1980, p.147.

7. L'Italia economica nel 1918, Roma 1919, quoted in Castronovo, p.147.

8. Epistolario 1911-1926, Milano, 1968, vol. II, La grande guerra, pp.408-409, quoted in Castronovo, p. 139.

9. Paola Carucci, "Funzioni e caratteri del Ministero per le armi e munizioni," in Procacci, ed., Stato e classe operaia, p.63.

10. ibid., p.64.

11. ibid., p.63.

12. ibid., p.64.

13. Vittorio Franchini, I comitati regionali di Mobilitazione Industriale, 1915-1918, Milano-Roma, 1929, p.5.

14. Carucci, "Funzioni e caratteri," p.67.

15. ibid., p.69.

16. ibid., p.74.

17. Franchini, I comitati regionali, p.21.

18. Procacci, "Introduzione," p.20.

19. Luciano Segreto, "Armi e munizioni. Lo sforzo bellico tra speculazione a progresso tecnico," Italia contemporanea, n.146-147, 1982, p.37.

20. Camera dei Deputati, Relazione della Commissione parlamentare d'inchies per le spese di guerra, vol. II, p.10, quoted in Segreto, "Armi e munizioni," p.37.

21. Franchini, I comitati regionali, p.11; sub-quote from law n.1277, 22 Aug. 1915.

22. ibid., p.12.

23. ibid., p.13.

24. ibid., p.39.

25. ibid., p.51.

26. ibid.

27. ibid., p.69.

28. Segreto, "Armi e munizioni," p.37. In the case of FIAT, the growing competition with Ansaldo in Genova evidently took precedence over "the patriotic spirit" in June 1918, when the company met with Swiss represe tatives of the German group Demag to draw up an agreement assuring FIAT supplies of materials for the manufacture of new steels in the post-war period. (Castronovo, L'industria italiana dall'ottocento ad oggi, p.143.

29. Segreto, "Armi e munizioni," p.39.

30. ibid., p.40.

31. ibid.

32. ibid.

33. Carucci, "Funzioni e caratteri," p.66.

34. Title of chapter eight of James Weinstein, The Corporate Ideal in the Liberal State, 1900-1918, Boston, 1968.

35. Segreto, "Armi e munizioni," p.43.

36. ibid., p.44; Carucci, "Funzioni e caratteri," p.61; Alberto Caracciolo, "La crescita e la trasformazione della grande industria durante la prim guerra mondiale," in Giorgio Fua, ed., Lo sviluppo economico in Italia, Milano, 1969, pp.210-211.

37. Procacci, "Introduzione," p.20.

38. Carucci, "Funzioni e caratteri," p.74.

39. ibid., p.76.

40. ibid., p.75.

41. ibid., p.62.

42. ibid., p.61.

43. Procacci, "Introduzione," p.17.

44. Scagnetti, Gli enti di privilegio, p.64.

45. Castronovo, L'industria italiana, p.148.

Footnotes. The Legacy of War. The Socialization of Production and the "Decline" of the Bourgeoisie

1. Scritti di economia e finanza, v., Saggi economici vari, disegni di legge discorsi, ed. F. Vianello, P. Sylos Labini, Bari, 1969, p.465, quoted in Silvio Lanaro, Nazione e Lavoro, Padova, 1979, p.264.

2. ibid., p.273.

3. La dittatura della borghesia e la decadenza della società capitalistica, Napoli, 1924, in Lanaro, p.275.

4. "Mobilitazione Industriale ed assetto delle industrie dopo la guerra," Bollettino del comitato Centrale di Mobilitazione Industriale, n. 3, Sept 1917, p.74.

5. ibid., p.73.

6. Ingegneria Italiana, n.79, 3 July 1919, p.9.

7. Toniolo, "Mobilitazione Industriale," p.74

8. ibid.

9. ibid.

10. ibid., pp.77-79.

11. Dwight T. Farnham, America vs. Europe in Industry. A Comparison of Industrial Policies and Methods of Management, London, 1921, pp.4-9.

12. The implications, as felt by contemporaries, of such innovations for the modernization of the basic social and political structures of the entire society had been cryptically cited earlier by Veblen, with specifi reference to Germany, in 1915:

> Whether in peace or in war, that is to say whether as a business proposition or as a proposition in international politics, modern technology does not tolerate a miniscular state after the fashion of the German principalities...This technology and the business community in whose usufruct the modern state of the industrial arts lives and moves is of an impersonal and cosmopolitan character. Personal idiosyncrasies, local traits and national frontiers are disserviceable rather than otherwise in all that concerns the life of trade and industry in modern times. (Imperial Germany and the Industrial Revolution, N.Y., 1964, p.176.).

13. Augusto de Marsanich, "Il punto fermo," Critica Fascista, II, 17, 1 Sep 1924, p.61.

14. "La mostra campionaria delle toscane durante lo stato di guerra - discorso di S.E. l'on. ing. Cesare Nava," Bollettino del Comitato Centrale di Mobilitazione Industriale, n.13, July 1918, pp.229-232.

15. ibid., p.230.

16. ibid., p.231.

17. ibid.

18. ibid. p.232.

19. This proposal was strikingly similar to the subsequent fascist conception of economic and social management through the dual power structure of the provincial economic councils and the syndical organizations, to reduce - as Belluzzo expressed it using a phrase coined by Henri Fayol - "plurality of command". (Giuseppe Belluzzo, Economia Fascista, Roma, 1928, pp. 50-106).

20. Cesare Nava,"Discorso di S.E. L'on. ing. C. Nava, pronunziato nella seduta del 29 Luglio 1918 del Comitato Centrale di Mobilitazione Industriale," Bollettino del Comitato Centrale di Mobilitazione Industriale, n.13, July 1918, p.232.

21. ibid., p.233.

22. ibid., p.233.

23. Nello Quilici, Origine, sviluppo e insufficienza della borghesia italiar Ferrara, S.A.T.E., 1932, p.308.
By "bourgeois" Quilici was referring to the middle class in Italy who had traditionally refused to mobilize themselves and "do their duty" as good bourgeois economic actors and pledge themselves to capitalist development.

24. ibid., p.6

25. ibid., p.315.

26. ibid., p.297.

27. ibid., p.308.

28. Corrado Gini, "Il costo della guerra," in Problemi sociologici della guerra, Bologna, 1921, quoted in Valerio Castronovo, L'industria italiana dall'ottocento ad oggi, p.150.

29. Sviluppo e cultura alle origini dell'Italia industriale, Milano, 1984, pp.84-85.

30. F. Lori, "L'elettrotecnica in Italia nell'ultimo venticinquennio," L'Elettrotecnica, vol. X, n.14, 15 May 1923, p.302.

31. L'industria, XXXIV, 11, 15 June 1920, p.281.

Footnotes. Class Struggle and the Rearticulation of the Engineering Ideology: The Vision of Pietro Lanino

1. Felice Corini, "La riforma dell'insegnamento tecnico," Ingegneria Italiana, vol. III, n. 61, 27 Feb. 1919, p.84.
2. Ingegneria Italiana, n.57, 30 Jan.1919, p.72.
3. Biographical information on Lanino from "L'ing. Pietro Lanino," Rivista Tecnica delle Ferrovie Italiane, a. XIX, vol. XXXVIII, 15 Nov., 1930, pp.217-220.
4. ibid., p.217.
5. ibid.
6. ibid., p.218.
7. "Note per la commissione del dopoguerra. Sotto commissione produzione industriale, Gruppo Organizzazione Industriale," Ingegneria Italiana, 10 Oct. 1918, n.42, pp.216-218; n. 44, 24 Oct., 1918; n.45, 31 Oct., 191 n. 43, 17 Oct., 1918.
8. Pietro Lanino, Degli Scioperi sulle Ferrovie Italiane, Collegio-Sindacat nazionale degli ingegneri ferroviari italiani, Roma, 1920.
9. "L'ing. Pietro Lanino," Rivista Tecnica delle Ferrovie Italiane, p. 220.
10. "Note per la commissione del dopoguerra," Ingegneria Italiana, 31 Oct. 1918, n.45, p.260.
11. ibid.
12. "La grande industria nella guerra e nel dopo-guerra," Ingegneria Italiana, vol. IV, n.95, 30 Oct. 1919, pp.225-230.
13. ibid., p.226.
14. ibid., p.225.
15. ibid.
16. Fascism and the Industrial Leadership in Italy, 1919-1940, Berkeley and Los Angeles, 1971, p.8.
17. Lanino, "La grande industria nella guerra," op.cit., p.226.
18. ibid.
19. ibid.
20. ibid., p.227.
21. ibid., p.229.

22. ibid. Although perhaps some technical reformers of the period may have found some "contradiction" in the fact, it was nonetheless the case that one of the main protagonists of this speculation in the marine transport sector was Riccardo Gualino, who in the 1920s would, through his company Snia Viscosa, command almost a total monopoly over the artificial fibres industry in Italy.

Gualino's fortune had been built on real estate speculation, not the least ambitious of his schemes being the acquisition of 2.6 million square meters of the city of St. Petersburg in 1911, which included the stock market and the university. These interests were appropriated by the Soviet government after the revolution. In 1917, with the financial collaboration of Giovanni Agnelli, he founded the societa' di navigazione italo-americana to import American coal into Italy. The 1920-21 miners' strike in the United States more or less finished Gualino's activities in this sector. Later on in 1926-27, the business collaboration with Agnelli was terminated because of Gualino's efforts to import French cars into Italy. By this point, however, he had already become virtually the sole producer of artificial fibres in the country, and his company Snia viscosa had become an industrial power in its own right. (M.C. Cristofoli, M. Pozzobon, I tessili Milanesi, Milano, 1981, pp.76-7

23. Lanino, Degli scioperi sulle ferrovie italiane, Roma, 1920, p.3

24. ibid., p.4.

25. ibid., p.8.

26. ibid., p.9.

27. ibid.

28. ibid., p.10.

29. ibid., p.11.

30. ibid.

31. Lanino was to have another occasion to attack the reformist proposals o Ciuffelli, in December 1918, this time regarding the more general questi of corporatist representation in the political structure. Ciuffelli had prepared a document proposing that official recognition of professional associations connected to an industry or group of industries would be th responsibility of the Ministry of Industry and Commerce. These assoc- iations would in turn be called to designate representatives for the industry with which they were linked, to work in an expert consultative capacity inside the ministry.

Lanino's comment was that, indeed, this was a point repeatedly stressed in Ingegneria Italiana, and in his own reports to the ministry of Industry and Commerce, as well as to the commissione del dopo-guerra. However, in Lanino's opinion Ciuffelli stopped short of the mark: such a reform should not be confined to the economics ministry only, but "should be extended to all consultative bodies of the state." Ingegneria Italiana, 5 Dec. 1918, p.340.

32. Degli scioperi sulle ferrovie italiane, p.11.

33. ibid., p.13.

34. ibid. p.15.

35. Ingegneria Italiana, 18 July, 1918, p.35.

36. Ingegneria Italiana, n.55, 16 Jan. 1919, p.40.

37. Degli scioperi sulle ferrovie italiane, p.15.

38. ibid., p.16.

39. ibid., p.17.

40. ibid.

41. Interestingly enough, this observation corresponds with the conclusions reached by Barrington Moore in a well-known study of "the social bases of obedience and revolt". After examining a myriad of sociological, historical and anthropological data, Moore summarized:

> Once human beings have learned to take certain social arrangements for granted as part of the way the world works, it is evidently quite difficult for them to change. The emotional satisfaction that the belief in a specific social function imparts can for long periods of time override the truth value, which is often very difficult to determine anyway. How can one ever be sure that bureaucrats, capitalists, party officials, military officers are not performing socially necessary labour? Only when the obsolete character of a dominant group becomes blatantly obvious through failure in competition with another society and culture is it liable to lose its legitimate right to appropriate the surplus extracted from the underlying population. (Injustice. The Social Bases of Obedien and Revolt, N.Y., 1978, p.43.

Mark Twain: "...there isn't anything you can't stand, if you are only born and bred to it." A Connecticut Yankee in King Arthur's Court, ed., Lawrence Teacher, opening remarks Kurt Vonnegut, Jr., The Unabridge Mark Twain, Philadelphia, 1976, p.992.

42. Lanino, Degli scioperi sulle ferrovie italiane, p.19.

43. ibid., p.19.

44. ibid., p.21.

45. ibid.

46. ibid.

47. ibid., p.26.

48. ibid., p.27.

49. ibid., pp.32-33.

50. ibid., p.33.

51. ibid.

52. ibid., p.37.

53. ibid., p.38.

55. In this regard it is worth noting that at the time Lanino was campaigning for a form of corporatist parliament, Francesco Mauro - engineer, management consultant, subsequent president of the International Scientific Management Association, and "one of the most important Italian scholars of the theory of industrial management between the wars" - was a parliamentary deputy for the Partito Popolare. (Quote from Giulio Sapelli, "Gli organizzatori della produzione tra struttura d' impresa e modelli culturali," Storia d'Italia, annali 4, Intellettuali e Potere, ed., Corrado Vivanti, Einaudi, Torino, 1981, p.640).

As a technical consultant, Mauro was a member of the first reformed fascist Ministry of Public Works in late 1922, and from 1926, together with Gino Olivetti, was editor of the journal L'organizzazione scientifica del lavoro. One of his major works of theory was Il capo nell'azienda industriale, in which he synthesized the necessary qualities of an industrial manager under the general heading of possessing the capacity to "guide" or "lead": "I preferred 'condurre' to every other verb because of its direct derivation from the latin 'ducere'". (Il capo nell'azienda industriale, p.20).

In a commercial context, "condurre" can also be used to mean simply "to manage".

56. Ingegneria Italiana, n.54, 9 Jan., 1919, p.25.

57. Ingegneria Italiana, 22 May 1919, p.1.

58. Ingegneria Italiana, n.33, 1 Aug. 1918, p.73.

59. "La funzione dell'ingegnere e la sua istruzione," Ingegneria Italiana, vol. IV, n.84, 7 Aug. 1919, p.69.

60. ibid.

61. Dwight Waldo, The Administrative State. A Study of the Political Theory of American Public Administration, N.Y. 1948, p.v.

62. "La funzione dell'ingegnere," op.cit., p.69.

63. "Tecnica e Politica," Ingegneria Italiana, n. 66, 3 Apr. 1919, p.226.

64. The term "lawyer" seems to have been used in the technical reform literature as a universal term of abuse, implying all the characteristic associated with clientelistic forms of political manoeuvring. In a November, 1919 editorial in Ingegneria Italiana, for example, one finds the following phrase in bold lettering: "THE JOB OF DIRECTOR GENERAL OF MINES WILL GO TO A LAWYER". (n. 99, 27 Nov. 1919, p.300).

That the existing parliamentary system was inherently hostile to efficient social organization was a point made by the engineer and economics writer for L'industria, Francesco Magri, in 1919:

> If reform is truly desired, steps must be taken gradually, and the reform program itself must be formulated in such a way to render gradual progress possible. This will never happen, however, unless the courage is found to break down some dominant concepts, amongst which that of considering all the offices of the state administrati of equal importance. This concept is more than simply wrong - it is iniquitous; a crude, anti-economic idea that conflicts with all the requirements of a modern administrative order.
>
> We do not believe it possible to make any public administratio

resemble a private one, and we have always considered the phrase "organize with industrial criteria" - of which so much use has been made to defend monopoly projects - an expression deprived of any practical value." ("Cronache economiche," L'industria, XXXIII, n.1, 15 Jan. 1919, p.95.

Political adminstration could not of course be eliminated entirely, and totally reconstructed as a public bureaucracy for exclusively economic and industrial affairs, but selective intervention and reform was both possible and necessary. For L'industria's economic editorialist, the situation was analogous to the argument against "parasitic" intermediaries in business, a critique which pre-dated world war I, "bu the conditions created by the war have formed an atmosphere favourable to its popularity." ("Cronache economiche," L'industria, vol. XXXIII, n. 5, 15 March, 1919, p.157.). Such an argument had been taken to extremes, the writer pointed out, since just as transforming cotton into cloth is an act of production, so for example was buying grain on the American market and selling it in Italy. Similarly, the question of political reform need not be reduced to advocating the dismantling of political offices altogether, which performed economic functions, rather selective streamlining should be undertaken to bring the functio of the state administration into closer conformity with the division of labour in society. (ibid.).

65. Ingegneria Italiana, n.35, 22 Aug. 1918, p.105.

66. "La riforma dell'amministrazione di Stato," Ingegneria Italiana, vol.II n.58, 6 Feb. 1919, p.81.

67. ibid., p.83.

68. Ingegneria Italiana, n.79, 3 July 1919, p.8.

69. Ingegneria Italiana, n.53, 2 Jan. 1919, p.8.

70. Ingegneria Italiana, 2 Oct. 1919, n.91, p.164.

Commenting on the metal workers' strike, the editorialist of L'industria complained that "a slow and deathly poison has been injecte into the consciousness of the working masses". Both government and private industry were at fault as well however, the one for not imposin order, the other for irresponsibility in neglecting the contribution of engineers in industrial management: "It is sad and deplorable that the government has never felt the need to admonish the working masses with pursuasive technical and economic arguments, to recall them to their duty as Italian citizens." As for the industrialists: "we say to (those) who believe they can resolve the industrial problem at the stoc market or through the banks that they are on the wrong track. The industrial problem is essentially a technical problem." (L'industria, vol. XXXIII, n.18, 30 Sept. 1919, p.545.).

71. Ingegneria Italiana, 2 Oct. 1919, n.91, p.164.

72. Ingegneria Italiana, n.141, 30 Sept. 1920, p.104.

73. Ingegneria Italiana, n.138, 9 Sept. 1920, p.76.

74. Ingegneria Italiana, n.144, 21 Oct. 1920, p.128.

75. Ingegneria Italiana, n.152, 16 Dec. 1920, p.194.

76. Giuseppe Bottai, "Per il partito, contro il partito," Critica Fascista, a.II, n.1, 1 Jan. 1924, p.138.

77. Critica Fascista, a.II, n.1, 1 Jan. 1924, p.287.

Footnotes. Engineers and the Politics of Order

1. "La partecipazione degli ingegneri alla vita politica e la riforma elettorale," Ingegneria Italiana, vol. IV, n.91, 2 Oct. 1919, p.157.

2. ibid.

3. ibid.

4. ibid., p.158.

5. ibid.

6. ibid.

7. "L'organizzazione industriale tedesca per il dopo guerra secondo Il Signor Rathenau," L'industria, vol.XXXIII, n.3, 15 Feb. 1919, p.67.

8.

8. ibid.

9. "Missione sociale e politica dell'Associazione Elettrotecnica Italiana," L'Elettrotecnica, vol. VI, n.23, 15 Aug. 1919, p.478.

10. ibid., p.479.

11. ibid., p. 478-479.

12. ibid., p.480.

13. "Nuovi orientamenti nei rapporti fra industriali e organizzazioni operaie," L'industria, vol. XXXIII, 1919, pp. 443-445.

14. ibid., p.443.
This had been a point long since insisted upon by the University of Florence economist and fascist supporter, Riccardo Dalla Volta. In his 1903 study, I problemi dell'organizzazione del lavoro, Dalla Volta had urged the abandonment of the traditional paternalistic mentality of the Italian entrepreneur, and lauded the British system of union representation, which had assumed the form of "improvement leagues," rather than the former combative character of "resistance societies". (I problemi dell'organizzazione del lavoro, Firenze, 1903, pp.168-169). In this new form, trade unions were an integral feature of modern capitalism: "they don't tend to destroy, but to harmonize the needs of the modern industrial system with the needs of the working class..." (ibid.). Collective labour contracts, industry wide, were in any case increasingly made necessary by the technical conditions of industry itself. Uniformity in the means of production required a similar streamlining in the contractual relations between capital and labour. (ibid., p.101). In Italy, Dalla Volta pointed out, collective labour contracts were practiced only in the printing industry, though since they were an "unarguable necessity of modern industry," they often were negotiated spontaneously in different sectors, even if such contracts were not given legal recognition. (ibid., 95-97). Like Francesco Magri after him, Dalla Volta stressed the technical, developmental and organizational prerequisites of such

structural conditions that were just beginning to emerge in Italian society: "They are the first steps towards a bargaining method that we find applied only where industry is strongly organized, and where the workers have reached a certain level of education and learned to avail themselves of the best means in their struggles with capital." (ibid., p.97).

15. Magri, "Nuovi orientamenti," p.443.

16. ibid.

17. Ingegneria Italiana, n.96, 6 Nov. 1919, p.242.

18. "Relazione sulla organizzazione della classe degli ingegneri letta dall'ing. Toia," Ingegneria Italiana, n.96, 6 Nov. 1919, p.243.

19. ibid., p.244.

20. ibid.

21. "Dopo lo sciopero di Torino," L'industria, XXXIV, 8, 30 Apr. 1920, p.20

22. "L'industria italiana ed il momento attuale," L'industria, XXXIV, 5, 15 March 1920, p.132.

23. ibid.

24. "I problemi economici dell'ora attuale," Politecnico, Jan. 1928, pp.9-11

25. ibid., p.10.

26. ibid., p.11.

27. Ingegneria Italiana, n.126, 10 June, 1920, p.325.

28. ibid.

29. "Tutela o lotta di classe?" Ingegneria Italiana, n.127, 17 June 1920, p.329.

30. Quoted in ibid., p.330.

31. "L'integrazione umana nel sistema Taylor," Ingegneria Italiana, vol.II, n.47, 14 Nov. 1918, p.48.

32. ibid.

33. ibid.

34. "La Francia ed il sistema Taylor," Ingegneria Italiana, n.52, 19 Dec. 1918, p.370.

35. ibid.

36. ibid. In April 1919 a similar plea and complaint had been made by Augusto Bardi in the pages of L'industria. ("Sulla formazione degli ingegneri," vol. XXXIII, n.7, 15 Apr. 1919, pp.196-197). Taylor

himself, Bardi explained, had already made the most important criticism of industrial employers, which emerged primarily in their relationship with technicians and engineers. In contrast with the present state of affairs in industry, Bardi argued, "the engineer must not simply be a technician...he must be a 'managerial element'...an individual who, if put in charge of a company, would be able to make it grow and prosper." (ibid., p.196). The sheer complexity of economic and social relationships in modern industry was increasingly drawing managerial and technical work together in the person of the modern industrial engineer: "Nowadays, every industrial problem...is linked by many other relationships (economic, financial, commercial) to the environment in which industry operates. It is the engineer's job to get to the bottom of the problem, by considering every side of the question, and avail himself of the expertise of his technical, accounting and commercial staff as regards details." (ibid.). The work of Fayol was lauded for th insight that in the industrial firm the administrative role of the technician and engineer was of basic importance. Institutionalized training in management for engineers was however dolefully lacking: "In our schools, who ever hears 'organization' spoken about." (ibid,197 Moreover, in addition to the dearth of accounting courses in Italian engineering schools, "another grave lacuna in our education system is to not habituate young people to the art of commanding." (ibid.) As had become almost standard practice in engineering discussion of industrial reform during this period, Bardi concluded with an affirmati reference to the emergent industrial empire to the west: "In America, the country that is always the teacher in any idea of progress, a movement had already begun before the war to reform engineering training." (ibid.).

37. Ingegneria Italiana, n.127, 17 June 1920, p.330.

38. L'Elettrotecnica, vol. IX, n.28, 5 Oct. 1922, p.682.

39. "Note politiche, economiche, finanziarie," L'Elettrotecnica, vol.X, n.20, 15 July, 1923, p.466.

40. L'Elettrotecnica, vol. X, n.35, 15 Dec. 1923, p.861.

41. L'Elettrotecnica, vol. VII, 25 June 1920, p.317.

42. ibid.

43. L'industria, XXXVII, 8, 30 Apr. 1923, pp.162-141.

44. "Note statistiche ed economiche," L'Elettrotecnica, vol. X, n.3, 5 Feb. 1923, p.87.

45. ibid.

46. ibid.

47. "L'industria italiana ed un'anno di governo fascista," L'industria, vol. XXXVII, n.21, 15 nov. 1923, p.56.

48. ibid.

49. ibid.

50. ibid.

51. "La Federazione Industriale Lombarda," L'industria, vol. XXXIX, n.13 15 July, 1925, p.330.

52. ibid.

53. ibid.

54. ibid.

55. ibid.

56. ibid.

57. ibid., Magri's emphasis.

58. Francesco Mauro, Il Capo nell'azienda industriale, Milano, 1941, p.59.

59. ibid.

60. Vincenzo Masi, "Corso di economia politica," Corso di lezioni tenute all'universita fascista di Bologna nell'anno accademico 1924-1925, p.37

61. See Albert O. Hirschman, Exit, Voice, Loyalty, Cambridge, Mass., 1970, p. 58: "Political power is very much like market power in that it permits the powerholder to indulge either his brutality or his flaccidit

62. "Liberalism in the progressive era - and since," James Weinstein wrote, "was the product, consciously created, of the leaders of the giant corporations and financial institutions that emerged astride American society in the last years of the nineteenth century and the early years of the twentieth century...the new liberalism incorporated the concepts of social engineering and social efficiency that grew up alongside of of industrial engineering and efficiency. The corollary was a disparagement of 'irresponsible' individualism and localism." The Corporate Ideal in the Liberal State, 1900-1918, Boston, xiv-xv.

Footnotes. Public Administration and the Rationalization of Power. The Reform Vision in the state

1. "La politica e l'amministrazione," Critica Fascista, II, 13, 1 July, 1924, p.520.

2. "Italian Fascism," in Walter Laquer, ed., Fascism: A Reader's Guide, Harmondsworth, 1976, p.87.

3. D'Andrea, "La Politica e l'amministrazione," p. 520.

4. ibid.

5. "La classe dirigente i il suo Duce," Gerarchia, a.V, n.1, Jan. 1926, p.6.

6. "L'organizzazione scientifica nelle aziende pubbliche. Appunti sui rapporti interferenziali tra le funzioni del prevedere, dell'organizzare del comandare, del coordinare e del controllare," L'organizzazione scientifica del lavoro, a. II, n.1, Feb. 1927, p.38.

7. ibid.

8. "Self-control" was of course one of the standard saws of human engineerir in the 1920s. From across the Atlantic a touch of collegiate solidarity was contributed to the discourse. In a sort of managerial chap-book of 1929, Arthur Frederick Sheldon sagaciously explained that "useful ideals are profitable. Harmful ideals are expensive," elaborating the point by identifying the "four good things of life"(The Big Four): health, harmony, respect and "plenty of money". And the means to achieve "The Big Four" were laid out in the "first class yell":

> Rah, rah, rah,
> I must reduce NS (= need of supervision) to zero
> That's the way to do things right
> that's the way to win the fight.

(Human Engineering. The Builder's Guide, 1929, p.6.)

9. Molinari, "L'organizzazione scientifica nelle aziende pubbliche," p.38.

10. Silvio Molinari, Profili di una organizzazione scientifica del lavoro amministrativo, 1927, p.216.

11. ibid., pp.214-215.

12. ibid., p.222.

13. In the United States of the same period, following more closely the logic of such a program, "industrializing the bureaucracy" meant, in effect, wholesale possession of the sphere of politics by organized business. As Leonard D. White, professor of political science at the University of Chicago explained to his audience at the Rome internationa scientific management conference in 1927: "In the last quarter century American municipal administration has been subject to two great streams of influence. On the one side there continued to beat against city institutions a flood of partisanship, favouritism, spoils, and corruptic but with diminishing vigor. On the other hand the cross current of business influence mounted ever higher and higher, as the intollerable

results of politician government in the modern world became apparent...on the whole it may now be confidently stated that city government has been redeemed, and within the limits set by the conditions of American democracy, is operating with fair business efficiency."
("The influence of American business administration on municipal administration," Atti del III congresso dell'organizzazione scientifica del lavoro, Roma 1927, sezione III, p.183.).

14. "Il fascismo e i tecnici," in La restaurazione finanziaria, Zanichelli. n.d., p.43.

15. Quoted in Piero Calandra, Storia dell'Amministrazione Pubblica in Italia Bologna, 1978, p.268.

16. Archivio Centrale dello Stato, Presidenza del Consiglio dei Ministri, "Riforma della pubblica amministrazione," 1921-1924, busta 3, fascicolo 9, sotto-fascicolo 5, first report 1 June 1921, second report, 2 June 1921.

17. ibid., p.2.

18. ibid.

19. ibid.

20. ibid., p.3

21. ibid.

22. ibid.

23. ibid.

24. ibid., p.4.

25. ibid., p.7.

26. Critica Fascista, III, 4, 15 Feb. 1925, p.77.

27. English phrase in the original. Sen. Rava, Discorso al Senato sui: provvedimenti per la riforma dell'amministrazione dello state, la semplificazione dei servizi e la riduzione del personale, Roma 1921, p.5.

28. Archivio Centrale dello State, Presidenza del Consiglio dei Ministri, "Riforma della pubblica amministrazione," 1921-1924, busta, fascicolo 2 "Relazione del sottosegretario di state alla PCM", p.77. Acerbo would be responsible for the electoral law of the 23rd of July 1923, which guaranteed two-thirds of the seats to the party with a relative majority of votes.

29. ibid.

30. ibid.

31. Critica Fascista, III, 4, 15 Feb. 1925, p.77.

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Critica Fascista (1924-1929)

L'Elettrotecnica (1919-1930)

Gerarchia (1926-1933)

L'Industria (1919-1933)

L'Ingegnere (1927-1929)

Ingegneria Italiana (1918-1922)

L'Organizzazione (1930-1932)

L'Organizzazione scientifica del lavoro (1926-1932)

Il Politecnico (1922-1928)

Rivista delle comunicazioni (1925)

Rivista d'Italia e d'America (1925-1926)

Rivista tecnica delle ferrovie italiane (1912-1930)

Archival Material

Archivio Centrale dello Stato, Presidenza del Consiglio dei Ministri, Riforma della pubblica amministrazione, 1921-1924.

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33. ibid., p.4

34. ibid.

35. ibid., p.6.

36. ibid.

37. ibid., p.11.

38. ibid.

39. ibid., p.12.

40. ibid.

41. Vita aziendale. Tecnica, organizzazione ed etica, Milano 1938, pp.110-112.

42. Critica Fascista, V, 18, 15 Sept. 1927, pp.354-356.

43. Atti del III congresso internazionale dell'organizzazione scientifica del lavoro, Roma 1927, part I: resoconti del congresso, volume unico., p.82.

44. Remo Malinverni, "La razionalizzazione dell'amministrazione statale," L'organizzazione scientifica del lavoro, a.III, n.2, Nov. 1928, p.707

45. ibid.

46. Ettore Lolini, "Il punto di partenza per la riforma della pubblica amministrazione," Critica Fascista, VI, 22, 15 Nov. 1928, p.84.

47. Renato Spaventa, Burocrazia, ordinamenti amministrativi e fascismo, Milano, 1928, p.98.

48. ibid.

49. "Il punto di partenza," p.85.

50. ibid.

51. ibid., p.86.

52. Raffaele Numeroso, L'organizzazione scientifica del lavoro nelle pubbliche amministrazioni, Napoli, 1933, p.14.

53. Critica Fascista, VI, 21, 1 Nov. 1928, p.63.

54. Numeroso, L'organizzazione scienfifica del lavoro, p.14.

55. Spaventa, Burocrazia, p 104.

56. ibid., p.103.

footnotes pp.249-250

57. Numeroso, L'organizzazione scientifica del lavoro, p.40.

58. ibid., pp.41-44.

59. ibid., p.48.

60. "Una rappresantanza della redazione di Mente et Malleo ricevuta da S.E. Giuseppe Bottai," L'organizzazione scientifica del lavoro, a.V, n.8, Aug. 1930, p.396.

Footnotes. Conclusion.

1. Discussions of the question of "idea diffusion" are always problematic, particularly perhaps as regards technology related ideas. The diffusion of social reformist programs based on technical considerations can clearly not be analytically separated from the production process innovations themselves, of which the ideas form a part. As Edwin Layton pointed out in considering the question of the diffusion of scientific management and mass production from the United States to Europe, "Achieving a technical goal involves the development of an engineering design, normally expressed in drawings, plans, and specifications which cannot easily be translated into words... It is often useful to distinguish between the overall design or system and its specific content...A design idea, such as that of a truss bridge, can be executed in many ways, using different materials and techniques. The existence of technological options makes possible an interchange of ideas on yet a fourth level. Social needs can produce important changes in an innovation which serve to adapt it to a particular cultural context...technology is increasingly taking the form of a rationally understood body of scientific information. A scientific technology increases the number of options, and hence, the potential for adaption...The knowledge that something could be done stimulated others to do something similar, but in their own distinctive way."
"The diffusion of scientific management and mass production from the U.S. in the Twentieth Century," Proceedings of the 16th International Congress in the History of Science, vol. 4, Tokyo, 1974, pp.377-378.
The process is clearly more complex than the mere transfer of ideas by the spoken or written word, and although some of the engineering literature looked at in this thesis reveals some acquaintance with experiments abroad such as Hoover's at the commerce secretariat, this should not be considered as separate from the more important mechanisms of "idea diffusion", such as, for example, the multinational corporation.

2. "The meaning of rationalization," Annals of the American Academy of Political Science, 1927, p.62.

3. Ellis W. Hawley, "Herbert Hoover, the Commerce Secretariat, and the Vision of an 'Associative State', 1921-1928," Journal of American History, June, 1974, pp.116-119.

4. ibid., p.123; sub-quotes from Herbert Hoover, "Waste in Government," May 22, 1925, Reorganization of Government file and commerce papers - official files, Herbert Hoover Papers, Herbert Hoover Library, West Branch, Iowa.

5. ibid., p.121.

6. The New Deal and the Problem of Monopoly, Princeton, 1966, pp.62-117.

7. Richard Kuisel, Capitalism and the State in Modern France: Renovation and Economic Management in the Twentieth Century, Cambridge University Press, 1981, p.48.

8. ibid., p.99.

9. Charles Steinmetz, "Individual and Corporate Development of Industry," General Electric Review, XVIII, 1915, p.816, quoted in David Noble, America By Design, p.42.

10. James Gilbert, Designing the Industrial State. The Intellectual Pursuit of Collectivism in America, 1880-1940, Chicago, 1972.

11. ibid., p.19.

12. quoted in ibid., p.187.

13. "The Future of Production," Annals of the American Academy of Political Science, 1927, p.34.

14. Gilbert, Designing the Industrial State, pp.8-9.

15. Quoted in Harry W. Laidler, "The New Capitalism and the Socialist," Annals of the American Academy of Political Science, 1927, p.21.

16. Lawrence Dennis, The Coming American Fascism, N.Y.,1936, pp.xii-198-199.

17. Industria e fascismo. Per una interpretazione dello sviluppo economico italiano tra le due guerre, Milano, 1976, pp.7-8.

18. The New Order and the French Economy, Oxford, 1970, p.v.

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