

Research Repository

Determinants and impact of production planning and control accounting techniques on competitiveness of manufacturing companies: a structural equation modelling approach

Babajide Oyewo (Department of Accounting, University of Southampton, Southampton, UK and Essex Business School, University of Essex, Colchester, UK)

Mohammad Alta'any (Department of Accounting, Business School, The Hashemite University, Zarqa, Jordan)

Kolawole Adeyemi Alo (Department of Accounting and Finance, De Montfort University, Leicester, UK)

Negroes Tembo Dube (School of Leadership and Management, Arden University, London, UK)

Accepted for publication in Accounting Research Journal.

Research Repository link: <https://repository.essex.ac.uk/39076/>

Please note:

Changes made as a result of publishing processes such as copy-editing, formatting and page numbers may not be reflected in this version. For the definitive version of this publication, please refer to the published source. You are advised to consult the [publisher's version](#) if you wish to cite this paper.

www.essex.ac.uk

Determinants And Impact of Production Planning and Control Accounting Techniques on Competitiveness of Manufacturing Companies: A Structural Equation Modelling Approach

Abstract

Purpose:

This study investigates four internal (organisational structure, quality of information technology, business strategy, and market orientation) and two external (competition intensity and perceived environmental uncertainty) contextual factors affecting the use of production planning and control accounting (PPC) techniques, as well as the impact of PPC usage on organisational competitiveness.

Design/ Methodology/approach:

Seven major PPC were investigated, namely attribute costing, lifecycle costing, quality costing, target costing, value-chain costing, activity-based costing, and activity-based management. By deploying a multi-informant strategy, a structured questionnaire was used to gather survey data from 129 senior accounting, finance, and production personnel of publicly quoted manufacturing companies in Nigeria.

Findings

The results, using structural equation modelling, show that market orientation is the strongest determinant of PPC usage. The inability of competition intensity and perceived environmental uncertainty to notably affect PPC usage suggests that external environmental pressure to use PPC is weak. Although PPC techniques can engender organisational competitiveness, their interactive usage yields optimal results.

Originality/Value

The study contributes to knowledge in three ways by (i) presenting evidence that although PPC techniques can engender organisational competitiveness, it is their interactive usage that yields optimal results; (ii) empirically demonstrating that contextual factors influence PPC techniques usage in line with the contingency theory; and (iii) validating the diffusion of innovation theory that organisations will typically deploy PPC techniques because of their relative advantage of improving organisational competitiveness.

Keywords: competitive advantage; contingency theory; market orientation; Nigerian manufacturing sector; production planning and control

Acknowledgement: Authors are grateful to the Editor, Professor (Assoc.) Habib Zaman Khan and two anonymous reviewers for insightful comments and suggestions in improving the earlier versions of the paper.

1. Introduction

The volatility of the business environment, amongst other considerations, is putting pressure on manufacturing companies to adopt and implement innovative production planning and control techniques. Fierce competition, coupled with ever-changing customers' tastes and fashion, implies that the conventional *push-it-through* approach to production, whereby products are manufactured and pushed to the market without considering customers' demands, is no longer sustainable. Given that executing manufacturing cycles are capital-intensive—requiring large outlay on material, labour and overheads—manufacturers that will survive competition characterising the fourth industrial revolution in the 21st century would have to take a deliberate approach to production planning and control (Romanello & Veglio, 2022). Production planning and control requires efficient allocation of resources so that resources are available when needed in order to ensure the achievement of production targets. Production planning and control is central to the smooth-running of manufacturing operations and usually involves several processes such as developing a production plan, sourcing raw materials, scheduling when production will commence and cease, assigning workload to men and machines, detecting bottlenecks and loopholes in the production process and quality control (Dittfeld et al., 2022).

The multifaced nature of production planning and control activities requires deploying appropriate accounting techniques to assist in planning, monitoring, and controlling production costs (Sands et al., 2016a). This has caused production planning and control accounting techniques (PPC) to make inroads into production management. PPC is a collection of cost and management accounting techniques that assist manufacturing companies in managing production costs and optimising manufacturing capacity in such a manner that production outcomes are achieved. PPC is useful for planning the production process, costing resource utilisation, and controlling the cost of production (Tsai et al., 2015). Going by this conceptual definition, accounting techniques such as attribute costing, lifecycle costing, quality costing, target costing, value-chain costing, activity-based costing, and activity-based management belong to the panoply of PPC (Phan et al., 2014).

Given the importance of PPC, determinants of the adoption/ usage intensity of PPC as innovative management accounting techniques have been a matter of interest among researchers and practitioners, as evidenced by the gamut of studies on the subject (e.g., Cadez & Guilding, 2012; Ahmad & Zabri, 2015; Petera & Šoljaková, 2020). However, a literature review reveals specific gaps the current study seeks to address.

First, although various contextual factors affect the decision of manufacturing companies to implement PPC—including organisational culture, size, availability of skilled personnel, lifecycle, centralisation/ decentralisation structure, technology, competitive strategy, geographic dispersion, competition intensity, and environmental uncertainty, among others (Al-Mawali, 2015; Otley, 2016)—the debate is unsettled regarding the extent to which these factors affect PPC usage, as the result of prior studies is mixed (Ahmad & Zabri, 2015; Oyewo, 2022).

Second, given the benefits that may accrue from the utilisation of PPC—such as cost reduction, more reliable product pricing, better cost control, and improved quality of decision-making, among others— it has been suggested that the extensive usage of PPC can enhance the competitiveness of manufacturing companies (Adler et al., 2000; Phan et al., 2014). However, some scholars have argued that the benefits from deploying innovative PPC may not accrue to organisations (Yap et al., 2013), as evidenced by the low adoption rate of innovative management accounting techniques compared with the popularity/ high usage rate of traditional accounting techniques (Pavlatos & Paggios, 2009; Ahmad & Zabri, 2015). To resolve this contradiction, more studies are required on the benefits of PPC usage.

Third, while studies on the determinants and outcomes of adopting PPC techniques have received relatively much research attention in developed countries, this is not the case in developing countries (Oyewo, 2022). Considering that developed countries are more industrialised, witness higher standards of living/ strong economic growth, and have better institutional environments to implement management accounting innovations, more studies from developing countries are essential in understanding how environmental factors influence the adoption of PPC to enhance generalisability of results (Ahmad & Zabri, 2015; Petera & Šoljaková, 2020).

Fourth, there have been calls to use a multi-theoretical approach to explain the determinants of adopting innovative management accounting techniques. Such an outlook could result in more nuanced analysis and well-validated results. However, most prior studies have predominantly used the contingency theory (e.g., Otley, 1980; Cadez & Guilding, 2008; Petera & Šoljaková, 2020). Meanwhile, the diffusion of innovation theory could be beneficial in explaining the motivation for adopting PPC as an innovative management accounting technique (Rogers, 2003; Vagnani & Volpe, 2017).

Considering these gaps, the objectives of the current study are to evaluate the following, using empirical evidence from the Nigerian manufacturing sector: (i) determinants of PPC techniques usage; (ii) impact of PPC techniques' usage on organisational competitiveness. As a developing country, Nigeria is an important context for the current study for several reasons. First, it is conceivable that deploying PPC may resolve some of the Nigerian manufacturing sector's problems relating to production management. PPC usage may help address some challenges confronting manufacturing companies, particularly problems relating to reactive production pricing, poor product quality, production wastage, lack of long-term strategic plans in product design, and reluctance to utilise modern technology. Second, since PPC adoption encourages organisations to adopt forward-looking product costing (Phan et al., 2014), PPC usage should help manufacturing companies in Nigeria focus on long-term production plans and strategy formulation in product costing and pricing. Third, PPC usage is technology-driven (Romanello & Veglio, 2022); adopting PPC should prompt investment in modern technology and the acquisition of new skills to improve competitiveness.

The remainder of the paper is organised as follows. The next section presents the literature review. The research methods are described in Section 3, followed by results in Section 4, and discussion and conclusion in Section 5.

2. Literature Review

2.1 Overview of Production Planning and Costing Techniques

PPC is a collection of cost and management accounting techniques that are useful for planning the production process, costing resource utilisation, and controlling the cost of production (Tsai et al., 2015). PPC consists of techniques that can create value in organisations and support strategic decisions in the production process, such as pricing, process improvement, and business process re-engineering (BPR). Although various PPC techniques exist in the literature, a growing number of studies have identified seven major PPC techniques, namely attribute costing, lifecycle costing, quality costing, target costing, value-chain costing, activity-based costing, and activity-based management (Phan et al., 2014; Maelah et al., 2017). The current study focuses on these techniques.

2.1.2 Attribute Costing

Attribute costing considers products or services as a bundle of features. Such features distinguish a product from another, and the product cost is determined based on these features.

Attribute costing applies activity-based costing (ABC) to determine the cost of product features. This has led to the labelling of the technique as Attribute-based Costing (ABC II), connoting that it applies ABC to cost product features. It was on this reasoning that Pitcher (2015, p. 19) regards attribute costing as “an extension of activity-based costing using cost-benefit analysis (based on increased customer utility) to choose the product attribute enhancements that the company wants to integrate into a product”. Regarded as an extension of ABC, attribute costing utilises detailed cost-benefit analyses relating to information on customer needs (in terms of product performance attributes such as reliability, durability, and responsiveness) and the costs of the incremental improvements necessary to obtain these attributes. Attribute costing technique can be regarded as externally oriented PPC because the attributes of goods and services are determined according to customer requirements. Also, attribute costing bolsters the relevance of market orientation in management accounting and justifies its inclusion as a contextual factor affecting PPC usage because the attributes/features of products are determined according to customer requirements.

2.1.2 Lifecycle Costing

Lifecycle costing involves profiling costs over a product’s lifetime, including the pre-production stage. The Chartered Institute of Management Accountants (CIMA) official terminology cited in CIMA (2008, p. 168) defines product lifecycle as “The period which begins with the initial product specification, and ends with the withdrawal from the market of both the product and its support. It is characterised by defined stages including research, development, introduction, maturity, decline and abandonment”. Lifecycle costing is a technique for costing products over their lifecycle of introduction, growth, maturity, saturation, and decline (Geekiyanage & Ramachandra, 2020). Overall, the product lifecycle concept reflects the awareness that products have a lifespan, and this knowledge about product life-expectancy will influence pricing decisions. In price-fixation, management accountants must take into cognisance external happenings. Products with short lifespans would be priced quite highly, using (say) a skimming strategy, to ensure that the organisation recovers costs or investments. Long-life products may be priced using a penetration pricing strategy, whereby organisations introduce a product at a low price to capture the market and systematically increase the price after creating awareness. Lifecycle costing estimates costs over the entire lifecycle of products and services, seeking to minimise costs and maximise sales revenue over the products’ life (Tsai et al., 2015).

2.1.3 Quality Costing

Quality costs are costs associated with preventing, detecting, and remediating quality-related product issues. Quality costing allows an organisation to determine the extent to which its resources are used for activities that prevent poor quality of products or services that result from internal and external failures (Broday, 2022). Quality costing is underpinned by the concept of Total Quality Management (TQM). The initial diffusion and subsequent transplantation of Japanese management accounting techniques, including TQM, Just-in-time (JIT) production, quality control, and quality control cycles, have also entered management accounting techniques because of their emphasis on value-creating through the elimination of waste. ‘Quality’ in the TQM context means ‘getting it right the first time’ and improving continuously. Quality management becomes ‘total’ when applied to everything a business does (CIMA, 2013). In the TQM philosophy, failure and poor-quality costs are unacceptable, as it is inappropriate to consider an optimal level of quality in which the combination of costs of non-conformance and costs of conformance is minimised. An organisation that is not unaware of quality costs can control or reduce the costs to achieve betterment in customer satisfaction and value-creation.

2.1.4 Target costing

Target costing is a production cost planning technique aimed at reducing the lifecycle costs of new products while ensuring quality, reliability, and other consumer requirements by examining all possible ideas for cost reduction at the product planning, research and development, and prototyping phases of production. Cost reduction techniques, such as kaizen costing, value analysis, and continuous improvement, are applied to achieve the ‘target cost’. Target cost is a product cost estimate derived by subtracting a desired profit margin from a competitive market price. Target costing exploits cost reduction opportunities, such as continuous improvement. Target costing requires managers to think differently about the relationship between cost, price, and profit (CIMA, 2016). The conventional approach to production planning is a *push-it-through* technique whereby the cost of developing a product is ascertained, and a selling price is arrived at after adding a desired profit margin. Due to competition, a modern approach of *pull-it-through* termed ‘target costing’ is to develop a product concept and the primary specifications for performance and design and then determine the price customers would pay for that concept.

2.1.5 Value-chain Costing

Value-chain Costing is an approach to accounting that considers all the activities performed by an entity, from the design to the distribution of the product. The strategic implication of such a procedure is the possibility of exploiting the economies and efficiencies derived from the external linkages between the company, suppliers, and customers. Value-chain costing is a technique connected to value-chain analysis. Compared to the conventional production planning and control system, the value-chain analysis has an external emphasis, not only on competitors but also on suppliers and customers. Traditional production planning and control accounting techniques use a single driver (volume), applied at the organisational level, while value-chain analysis uses multiple cost drivers unique to each value activity (Phan et al., 2014). Value-chain analysis may be challenging to apply to service businesses because it was initially designed for use in manufacturing settings. Aside from the reservation that the value system may be challenging to apply to network organisations, the best use of the value-chain idea depends on adopting some part of ABC to establish the cost of value activities. The cost of analysis may exceed the benefits (CIMA, 2013).

2.1.6 Activity-Based Costing (ABC)

Activity-Based Costing (ABC) was developed as an alternative to traditional overhead absorption costing. The CIMA Official Terminology cited in CIMA (2008, p. 373) defines ABC as “an approach to the costing and monitoring of activities which involves tracing resource consumption and costing final outputs. Resources are assigned to activities and activities to cost objects based on consumption estimates”. Traditionally, virtually all costs (except for material and labour) were classified as indirect expenses (overheads) as it was implied that products did not cause the costs to be incurred. As overheads accounted for a small proportion of the total cost, misleading bases such as direct labour hours or direct labour cost produce negligible errors in product costs. ABC is recognised as a modern production planning and control tool that can be applied to improve the costing of overheads (Maelah et al., 2017). Whereas the traditional absorption costing system uses a two-stage apportionment technique whereby costs are initially related to cost centres (primary distribution) and then to cost objects (secondary distribution/ redistribution), ABC first relates overheads to activities or groups into cost pools and then costs to objects. The two processes are, therefore, very similar, but the first stage is different, as ABC uses activities instead of cost centres or functional departments. ABC traces the incurrence of overheads to activities that drive the cost to determine the cost of

products more reliably, resulting in more appropriate product pricing and well-informed product-mix decisions.

2.1.7 Activity-Based Management (ABM)

Recently, the emphasis has switched from using activity-based approaches for product costing to applying them to improve cost management through a technique called Activity-Based Management (ABM). Consequently, ABM uses information from an activity cost-analysis to improve organisational profitability (Phan et al., 2014). ABM is the application of ABC to an array of management accounting issues or the cost management application of ABC. ABM (that is, the application of ABC) offers the possibility of turning costs that were deemed to be fixed into variable costs; variability in this context is a function of managers' decisions about the level of expenditure and the speed at which the supply of resources should be changed as requirements change. Whilst absorption costing aims to recover costs, ABC aims to highlight inefficiency, and thus, cost drivers should be based on the possible level of activity instead of the expected level of activity (CIMA, 2013). ABC, therefore, enables management to identify resources that are not being fully utilised.

2.2 Determinants of Production Planning and Control Accounting Techniques Usage

According to the contingency theory, internal and external contextual factors influence the adoption and usage of PPC (Otley, 1980). The contingency theory states that the design of cost and management accounting systems may vary from one organisation to another because organisations are exposed to different internal and external business environments (Cadez & Guilding, 2008; Otley, 2016; Petera & Šoljaková, 2020). Four internal contextual factors (namely organisational structure in terms of centralisation/ decentralisation, quality of information technology, business strategy, and market orientation) and two external contextual factors (competition intensity and perceived environmental uncertainty) were investigated.

2.2.1 Organisational Structure

Organisational structure with respect to centralisation/ decentralisation of power and decision-making may affect PPC usage. Profiling products across their lifecycles requires an appropriate organisational structure in which divisional managers can make autonomous product pricing decisions with minimal head office intervention. Further, holding divisional managers fully accountable for production losses, production yield and product quality within their divisions requires the transfer of an appropriate level of authority commensurate with such responsibility

(thus the relevance of organisational structure as a contextual factor). Studies have shown that high environmental uncertainty encourages decentralisation (Kattan et al., 2007; Zhao & Zhao, 2015), while decentralisation promotes extensive use of PPC techniques to survive uncertainty (Abdel-Kader & Luther, 2008). Therefore,

H1: Decentralised organisational structure is positively associated with PPC usage.

2.2.2 Quality of Information Technology

The modern manufacturing process is automated, and the collection of production costs for planning and control purposes should be digitalised to be effective (Maelah et al., 2017). Thus, the quality of information technology may affect the successful utilisation of PPC. The extent to which ABM can be used depends on an organisation's ability to identify its main activities and associated cost drivers (CIMA, 2013). However, since production processes have recently been automated, information technology is critical to collecting and analysing product costing information. Whereas traditional cost analysis examines costs by types of expense for each responsibility centre, ABM analyses costs based on cross-departmental activities and, therefore, provides management information on why costs are incurred and on the output of activities in terms of cost drivers. By controlling the incidence of cost drivers, the associated cost can be controlled or reduced depending on the quality or robustness of information technology.

An activity-based costing system, and by extension, activity-based management, requires the collection of a wide array of data for cost pool and cost driver analysis (Phan et al., 2014)—it may be practically impossible to collect the information manually but electronically. Taken together, information technology capabilities and quality of information technology are critical to the deployment of PPC (Rosli et al., 2014; Maelah et al., 2017), thus:

H2: High-quality information technology is positively associated with PPC usage.

2.2.3 Business Strategy

Business strategy is a critical factor influencing the adoption of PPC (Cadez & Guilding, 2012). This may be anticipated, considering that most PPC techniques are underpinned by strategy. The CIMA Official Terminology cited in CIMA (2008) distinguishes between operational ABM and strategic ABM. In operational ABM, actions are taken based on activity-driver

analysis that increases efficiency, lowers costs, and improves asset utilisation. ABC can be used purely as an accurate cost accounting technique. Whilst an organisation with little or no strategy orientation will implement PPC techniques operationally, strategy-driven organisations will deliberately deploy ABM strategically. Thus, organisational strategy affects the implementation of PPC, while deliberate strategy formulation may propel the extensive usage of PPC techniques (Cinquini & Tenucci, 2010; Cadez & Guilding, 2012). This leads to the following hypothesis that:

H3: Deliberate strategy formulation is positively associated with PPC usage.

2.2.4 Market orientation

Market orientation is a concept that posits that organisations should always strive to satisfy customers. Organisations with strong market orientation always seek to create superior customer value through business process improvement and product innovation (Narver & Slater, 1990). The desire to satisfy customers' demands by introducing products that constantly appeal to their needs will prompt organisations to use PPC (Al-Mawali, 2015). Deploying a combination of PPC techniques, such as attribute costing, quality costing, and target costing, to minimise production costs requires a consciousness to create value for customers. Similarly, deploying ABC to ensure the appropriate allocation of overheads to products, to arrive at an appropriate price for products and to create value for customers (by ensuring customers get value for their money) requires strong market orientation (Tsai et al., 2015). Manufacturing a product within a target cost to sell at a target price to achieve target profit is a competitive strategy that requires deliberate and pre-planned effort (Oyewo, 2022). This discussion informs the following hypothesis that:

H4: Market orientation is positively associated with PPC usage.

2.2.5 Competition

The need to survive a high level of competition may prompt the extensive usage of PPC techniques, given that PPC can enhance competitive advantage (Peters & Šoljaková, 2020). Bruns & Kaplan (1987) contend that competition is the most important external factor stimulating new cost and management accounting system installation. Chenhall (2003) argues that environmental uncertainty is the most critical factor affecting the adoption of innovative production cost and management techniques. Empirically, studies have shown that PPC

techniques have a higher level of adoption in a highly competitive environment characterised by uncertainty (Kattan et al., 2007; Ahmad & Zabri, 2015). Therefore,

H5: Competition intensity is positively associated with PPC usage.

2.2.6 Perceived environmental uncertainty

The unpredictability of the business environment may affect the type and usage intensity of PPC techniques (Zhao & Zhao, 2015). A greater level of uncertainty in the environment causes higher importance to be attached to externally oriented and market driven PPC techniques (Kattan et al., 2007; Oyewo, 2022), while low environmental uncertainty characterising a relatively stable business environment makes predictions about the market more accurate, thus reducing the dependence on PPC (Chapman, 1998). It may, therefore, be expected that:

H6: Perceived environmental uncertainty is positively associated with PPC usage.

2.4 Impact of Production Planning and Costing Techniques Usage on Organisational Competitiveness

The contingency theory supports deploying innovative PPC techniques to improve organisational competitiveness (Otley, 2016; Petera & Šoljaková, 2020). The diffusion of innovation theory also bolsters the argument for deploying innovative PPC techniques to improve organisational competitiveness. According to Rogers' diffusion of innovation theory, innovation attributes such as relative advantage, compatibility, complexity, trialability, and observability may influence the adoption of management accounting innovation (Rogers, 2003). Relative advantage is the degree to which an innovation is perceived as being better than the idea it supersedes. The diffusion of innovation theory applies to the current study by suggesting that the relative benefits of adopting PPC in improving organisational competitiveness will drive its adoption and usage. Thus, a positive association between PPC usage and competitive advantage may be anticipated (Vagnani & Volpe, 2017).

Although the PPC techniques are developed in isolation and promoted individually, combining their use could offer synergistic benefits to organisations (Adler et al., 2000; Sands et al., 2016b). Noting that the expected benefits from one technique may depend on the use of another technique, scholars have suggested that their interactive usage yields optimal benefits (Phan et al., 2014). Lifecycle costing could be used in customer profitability analysis, and ABC costing could be applied to allocate non-production costs. Lifecycle costing can be applied to target costing to reduce the lifecycle costs of new products. TQM is also applied to ensure the quality

of the products as well as cost reduction techniques such as kaizen costing. Applying functional analysis in a target costing setting could require the use of ABC, whereby an ABC system will provide useful information about what drives specific overheads in the organisation. These cost drivers can then link overhead costs to individual/ group of functions so that when a function is changed, a basis for ascertaining the effect on the overheads is available. ABC can be used with customer profitability analysis to determine more accurately the profit earned by servicing customers. ABC can also be used by retail organisations to analyse direct product profitability. Customer profitability analysis could be applied to lifecycle costing. Customers can be costed over their expected lifecycle, and the expected future cash flows relating to the customer may be discounted. Kaizen costing has applications in product target costing, lifecycle and Total Quality Management (TQM). This discussion informs the proposition that:

H7: Integrative use of PPC enhances organisational competitiveness.

3. Research Methods

3.1 Research Design

The study adopted a quantitative research design. The survey method was used to gather primary data using a structured questionnaire in line with prior studies (Cadez & Guilding, 2012; Petera & Šoljaková, 2020). The study population comprises manufacturing companies listed on the Mainboard (first-tier security market) of the Nigerian Stock Exchange (NSE). A list of the manufacturing companies obtained from the NSE website (<http://www.nse.com.ng>), which categorised the companies into seven industries, revealed 62 firms in the manufacturing sector as of December 2018. This consisted of Agriculture (4), Consumer Goods (21), Healthcare (8), Industrial Goods (17), Conglomerate (5), Natural Resources (4), and Information & Communications Technology (3).

3.2 Response Rate

From the list of the 62 firms quoted on the NSE, four firms were found to have discontinued operations, one merged with another, and one firm is no longer engaged in manufacturing activities but trading business. These six firms were excluded from the study, leaving 56 manufacturing firms. A multi-informant strategy was deployed by administering three copies of the questionnaire in each of the 56 companies, making a total of 168 copies administered. The target respondents are senior accounting, finance or production personnel who are sufficiently knowledgeable about their organisations' production planning and costing

processes. To ensure the target respondents completed the questionnaire, a cover letter explaining the purpose of the study and specifying the target respondents accompanied the questionnaire. From the 168 copies of the questionnaire administered, 131 copies were retrieved, with two copies found unsuitable for use because they were not properly completed, thereby reducing the number of useable copies to 129. This diminished the effective response rate to 76.7%. The 129 valid responses were processed for analysis.

3.3 Measurement of variables, validity and reliability

Seven PPC techniques were investigated, notably attribute costing (ATC), life cycle costing (LCC), quality costing (QLC), target costing (TGC), value-chain costing (VCC), activity-based costing (ABC), and activity-based management (ABM). The techniques were briefly described in the questionnaire, using the approach applied in prior studies (Cadez & Guilding, 2012). Six contextual Factors affecting PPC usage were included in the study. Organisational competitiveness (CAD) was measured across seven dimensions of competitive advantage (Cadez & Guilding, 2012). Three firm-level control variables that may affect PPC usage were included in the study, namely organisational size, SIZE (measured by Revenue), market presence, VALUE (measured by Tobin's Q) and profitability (measured by Returns on Total Assets, ROA (Ahmad & Zabri, 2015). Variable measurement is summarised in Appendix 1.

We apply exploratory (EFA) and confirmatory factor analysis (CFA) to examine the validity and reliability of multiscale items (i.e., PPC usage and CAD) as the first and second order of analysis, respectively (Gerbing & Hamilton, 1996; Cadez & Guilding, 2012). For EFA, all items loaded strongly above 0.70 for PPC usage and CAD, respectively, on component 1. We compute the Cronbach alpha and KMO coefficients reported in Appendix 1 (panel B) to assess reliability/ internal consistency. Further, CFA scrutiny confirms strong factor loading, as shown in Appendix 2 and Appendix 3. Although EFA and CFA result shows evidence of convergent validity, we also compute average variance extracted (AVE) for PPC usage (AVE = 0.723) and CAD (AVE = 0.712), which are above the recommended threshold of 0.50 (Fornell & Larcker, 1981). Discriminant validity was evaluated using correlation analysis, and the result shows low correlation strength among variables (Table 3). Construct validity was achieved by operationalising variables using existing measurements in the literature (Appendix 1). Structural equation modelling (SEM) with Maximum likelihood (ML) estimation technique was applied to assess the complexity of the relationship between variables.

4.Results

4.1 Descriptive Statistics

Descriptive statistics on the usage rate of PPC techniques are presented in Table 1, whilst descriptive analysis of the contextual factors and firm attributes is reported in Table 2.

[insert Table 1 about here]

[insert Table 2 about here]

The result in Table 1 shows that the usage rate of the PPC techniques is generally moderate, as the mean scores of the seven techniques range from 2.69 (for Target costing) to 3.47 (for quality costing) on the 5-point measurement scale. However, the high standard deviation coefficients (1.195 to 1.401) suggest that the usage rate varies considerably among the manufacturing companies. The overall mean of 3.11 out of 5.00 (equivalent to 62.2%) for the seven techniques supports the inference that the usage of PPC techniques is still less popular among manufacturing companies in Nigeria. The results in Table 2 also show that the companies differ markedly in their internal and external contextual factors and firm-level attributes. This heterogeneity in PPC usage rate, contextual factors, and firm attributes provides a robust context for investigating the determinants and impact of PPC usage in the Nigerian setting. The result of CFA in Appendix 2 shows that all PPC techniques loaded above the 0.60 threshold. The same applies to all seven items measuring organisational competitiveness (CAD) in Appendix 3.

4.2 Correlation and Multicollinearity Diagnosis

Before performing SEM analysis, multicollinearity among the variables was assessed using Pearson correlation. The result is reported in Table 3.

[insert Table 3 about here]

In Table 3, the correlation coefficient is less than 0.90 in most cases, confirming that multicollinearity is not a concern (Tabachnick & Fidell, 2001) and providing empirical evidence on discriminant validity.

4.3 Baseline Result

The result of the analysis of the relationship among variables using SEM is presented in Table 4 and Figure 1.

[insert Figure 1 about here]

[insert Table 4 about here]

From the result in Table 4, organisational structure, STRC ($b = -.012, p > .05$), has a negative and insignificant impact on PPC usage; hence, we reject H1. Quality of information technology, QIT ($b = .185, p > .05$), and deliberate strategy formulation, STRG ($b = .127, p > .05$), have positive coefficients, but their impact is not statistically significant. Thus, we reject H2 and H3. Market orientation (MKT) emerged as the strongest determinant of PPC usage ($b = .424, p < .05$); therefore, H4 is accepted. Competition intensity, CMPT ($b = .088, p > .05$), and perceived environmental uncertainty, PEU ($b = .117, p > .05$), both have positive but insignificant impact. We reject H5 and H6. Concerning the extent to which the deployment of PPC engenders competitive advantage, the impact of PPC usage on organisational competitiveness is positive, strong, and statistically significant ($b = .812, p < .05$). We accept H7.

The variables were linked as covariates to investigate further how the interaction between the contextual factors affects PPC usage and organisational competitiveness. This is informed by the consideration that organisational design elements interrelate as subsystems to achieve organisational outcomes (Oyewo et al., 2022). Moreover, the interaction approach to contingency theory suggests that the interaction of pairs of organisational context-structure factors affects organisational performance (Drazin & Van de Ven, 1985). Guided by these arguments, the contextual factors are linked as covariates, and the results are presented in Table 5 and Figure 2.

[insert Figure 2 about here]

[insert Table 5 about here]

Result in Table 5 and Figure 2 shows weak interaction between the contextual factors except for some interactions that are statistically significant but moderate such as (STRC Vs MKT = $.670, p < .05$), (QIT Vs MKT = $.649, p < .05$), and (STRG Vs MKT = $.552, p < .05$). A closer examination of the result reveals that market orientation (MKT) produced the most significant

effect in all interactions with other variables. The result corroborates the earlier deduction that market orientation is a strong driver of PPC usage, supporting acceptance of H4. Assuming other factors significantly impact PPC usage (Table 4), the interaction effect would have been more to improve the usage rate of the PPC techniques (Table 1) and the overall impact of PPC usage on organisational competitiveness.

4.4 Robustness Check using alternative measure of PPC

To check the robustness of results to an alternative measure of PPC, a PPC index (PPCI) was generated by computing the composite mean of the seven PPC techniques in Table 1. Prior studies have used this approach (Cadez & Guilding, 2012; Ahmad & Zabri, 2015). The PPC index was modelled as an observed variable in the SEM analysis, and the results are reported in Table 6 and Figure 3.

[insert Figure 3 about here]

[insert Table 6 about here]

The results in Table 6 and Figure 2 show that market orientation is the strongest driver of PPC usage ($b = .481, p < .05$), supporting acceptance of H4. The other internal contextual factors, such as quality of information technology, QIT ($b = .180, p > .05$) and deliberate strategy formulation, STRG ($b = .175, p > .05$), have positive but non-significant coefficients. The impact of organisational structure (STRC) on PPC usage is negative and not significant ($b = -.079, p > .05$). Whilst market competition (CMPT) has a positive but weak impact on PPC usage ($b = .225, p < .10$), perceived environmental uncertainty (PEU) has negative but insignificant impact ($b = -.002, p > .05$). This result supports the rejection of H1, H2, H3, H5 and H6. In sum, the direction of relationship, statistical significance, and effect sizes of variable coefficients in Table 6 are consistent with the results in Tables 4 and 5, confirming the robustness of the result that market orientation is the strongest determinant of PPC usage. Furthermore, the result is also consistent with earlier results (Tables 4 and 5) that PPC usage enhances organisational competitiveness ($b = .560, p < .05$), providing further support for acceptance of H7.

4.5 Robustness Check on the impact of interactive use of PPC on organisational competitiveness

Additional analysis was performed to examine the impact of the interactive use of PPC on organisational competitiveness. First, each of the seven PPC techniques was regressed on

organisational competitiveness (CAD) to assess their individual impact while controlling for firm-level attributes. The results are presented in Table 7 and Figure 4.

[insert Figure 4 about here]

[insert Table 7 about here]

The results in Table 7 and Figure 4 show that each technique makes no significant contribution to organisational competitiveness, except quality costing (QLC) with a low impact going by its beta coefficient ($b = .313, p < .05$). Meanwhile, quality costing has the highest usage rate in comparison to other techniques (Table 1), suggesting that PPC usage is positively associated with organisational competitiveness.

To assess the outcome of the interactive use of PPC techniques on competitive advantage, PPC was modelled as a latent variable and regressed on organisational competitiveness. Modelling PPC as a latent variable recognises that PPC techniques are often used complementarily. Results of the analysis are presented in Table 8 and Figure 5.

[insert Figure 5 about here]

[insert Table 8 about here]

The results in Table 8 and Figure 5 reveal that the combined usage of PPC techniques yields a more significant impact on organisational competitiveness ($b = .519, p < .05$). This contrasts sharply with the impact created by individual PPC techniques, with quality costing generating the highest impact ($b = .313, p < .05$). The result supports the argument that it is the interactive usage of PPC techniques that results in optimal benefit, hence acceptance of H7.

5. Discussion and Conclusion

The results show that market orientation (MKT) is the strongest determinant of PPC usage (Tables 4,5 and 6). This provides empirical evidence that organisations with strong market orientation always seek to create superior customer value through business process improvement and product innovation (Tsai et al., 2015). The positive but insignificant impact of the quality of information technology and deliberate strategy formulation (Tables 4-6) suggests that although the quality of information technology and taking a deliberate/proactive approach to strategy issues both have the potential to engender PPC usage, they make no appreciable impact in the decision of manufacturing companies to use PPC techniques extensively. This may be connected to the generally moderate level of these variables, with the

quality of information technology generally assuming a moderate level ($M = 3.915$). Similarly, the mean score of 3.111 for STR-DEL confirms that manufacturing companies are not typically concerned about taking a deliberate approach to strategy formulation. The negative coefficient of organisational structure, STRC (Tables 4-6), reveals that decentralisation of power and decision-making does not significantly impact PPC usage. These results fail to provide empirical support for the positive association between the level of decentralisation and the adoption of management accounting innovations (Abdel-Kader & Luther, 2008). The inability of organisational structure in terms of centralisation/decentralisation to drive PPC usage may be connected to the low level of decentralisation, as revealed by the mean score of 3.15 for STRC (Table 2).

Although the coefficients of the two external contextual factors (competition intensity and perceived environmental uncertainty) are positive, their impact is not statistically significant (Table 4). This reveals that the external pressure on manufacturing companies in Nigeria to adopt PPC techniques as a survival strategy is low. In Table 6 and Figure 3, the inability of both external contextual factors to notably affect PPC usage corroborates the argument that external environmental motivation to use PPC is weak. This may not be surprising, given the government's protectionism policy, which aims to reduce the exposure of the Nigerian manufacturing sector to international competition (Kolawole, 2022). The extremely low Mean score of 2.922 for PEU and the low standard deviation of .724 (Table 2) corroborates the argument that companies do not regard the environment to be so uncertain as to prompt the implementation of PPC techniques (Oyewo et al., 2022). This perhaps explains the popularity of traditional PPC techniques and a *push-it-through* approach to production by most manufacturing companies in Nigeria.

The results show that the impact of PPC usage on organisational competitiveness is strong, positive, and statistically significant (Table 4). This aligns with prior studies on the positive association between PPC techniques usage and competitive advantage (Phan et al., 2014; Oyewo, 2022). The result also provides empirical evidence for the diffusion of innovation theory that the relative advantage of an innovation will drive its implementation. Although the result shows that PPC usage impacts organisational competitiveness, it is conceivable that the impact could have been more significant, assuming there is a strong fit between the contextual factors. In Table 5 and Figure 2, the lack of synergy between the contextual factors may be responsible for the non-appreciable impact of PPC usage on organisational competitiveness. Similarly, the impact of PPC usage on organisational competitiveness could have been more,

assuming there is a synergy between the contextual factors. This makes it compelling for organisations to integrate organisational design elements to achieve optimal results (Oyewo et al., 2022).

Comparison of the result of Table 7 (and Figure 4) with that of Table 8 (and Figure 5) shows that the individual usage of PPC techniques does not deliver many benefits but their interactive use (Phan et al., 2014). The result that using the PPC techniques individually may not yield optimal results supports the interaction approach to the contingency theory, which states that the fit between organisational contextual factors produces the best outcome.

The study contributes to knowledge in three ways by (i) presenting evidence that although PPC techniques can engender organisational competitiveness, it is their interactive usage that yields optimal results; (ii) empirically demonstrating that contextual factors influence PPC techniques usage in line with the contingency theory; and (iii) validating the diffusion of innovation theory that organisations will typically deploy PPC techniques because of their relative advantage of improving organisational competitiveness.

Drawing from the positive association between PPC usage and organisational competitiveness, the study recommends that manufacturing companies should extensively apply PPC to improve their competitiveness. This is important, given the generally moderate usage rate of PPC techniques. Upgrading the usage intensity of PPC will require changes across organisations because this will involve switching from the *push-it-through* approach to production, typifying most manufacturing companies in Nigeria to a *pull-it-through* orientation underpinning the deployment of PPC. As conventional cost and management accounting techniques used by the companies for routine planning, control and decision-making have little or no consideration for the external business environment and business strategy, manufacturing companies in Nigeria will have to change to modern PPC to gain and sustain competitive advantage.

The current study has practical and policy implications for organisations. First, setting up a standalone management accounting department, removed from the general accounting/finance department, may help instil the appropriate skills to deploy PPC successfully. Second, drawing from the first policy implication, organisations should be ready to invest more in human capital development by training and developing accounting and non-accounting personnel involved in implementing PPC techniques in strategic business units and across the organisation. This can yield tremendous benefits in helping the companies better focus on customers' sentiments, competitors' activities, and other strategic issues such as strategic planning and control,

performance measurement, and decision-making. Third, considering that information is needed to implement PPC cuts across various functional departments, the successful deployment of PPC would require the cooperation of employees. The multi-disciplinarity of PPC requires an exchange of information between accounting and non-accounting departments. Thus, staff support is critical and top management must satisfactorily address any resistance to embracing change, such as facilitating open communication, allowing staff to make input to required changes, and objectively addressing the concerns of staff causing resistance to change.

The results show that the usage rate of the PPC techniques is generally moderate. Future studies may investigate the challenges of implementing management accounting innovations, which may explain why the PPC usage rate is low/ moderate using qualitative research design, such as interviewing key informers on management accounting practices at the organisational-wide level. This will address the limitations of the current study, which deploys survey research design. Considering that cultural factors (at organisational and national levels) affect management accounting practice, future research may examine determinants of PPC techniques usage in cross-country settings to enhance the generalisability of results.

References

- Abdel-Kader, M., & Luther, R. (2008). The impact of firm characteristics on management accounting practices: A UK-based empirical analysis. *The British Accounting Review*, 40(1), 2-27.
- Adler, R., Everett, A.M., & Waldron, M. (2000). Advanced management accounting techniques in manufacturing: Utilization, benefits, and barriers to implementation. *Accounting Forum*, 24(1), 131-150.
- Ahmad, K., & Zabri, S.M. (2015). Factors explaining the use of management accounting practices in Malaysian medium-sized firms. *Journal of Small Business and Enterprise Development*, 22(4), 762-781.
- Al-Mawali, H. (2015). Contingent factors of strategic management accounting. *Research Journal of Finance and Accounting*, 6(11), 130-137.
- Auzair, S., Amiruddin, R., Majid, A., & Maelah, R. (2013). Linking business strategy to management accounting: A study in Malaysian service organizations. *Jurnal Pengurusan*, 37, 45-52.
- Brodady, E.E. (2022). The evolution of quality: From inspection to quality 4.0. *International Journal of Quality and Service Sciences*, 14 (3), 368-382. <https://doi.org/10.1108/IJQSS-09-2021-0121>
- Bruns, W. J., & Kaplan, R.S. (1987). *Accounting and management: Field study perspectives*. Boston, MA: Harvard Business School Press

- Cadez, S, & Guilding, C. (2008). An exploratory investigation of an integrated contingency model of strategic management accounting. *Accounting, Organisations and Society*, 33(7-8), 836-863.
- Cadez, S., & Guilding, C. (2012). Strategy, strategic management accounting and performance: A configurational analysis. *Industrial Management & Data Systems*, 112(3), 484-501.
- Chapman, C.S. (1998). Accountants in organizational networks. *Accounting, Organizations and Society*, 23(8), 737-766.
- Chartered Institute of Management Accountants, CIMA (2008). *CIMA Paper P2: Management accounting: Decision management study text* (5th ed.). London: BPP Learning Media Ltd.
- Chartered Institute of Management Accountants, CIMA (2016). *Cost transformation model*. <https://www.cgma.org/Resources/Tools/DownloadableDocuments/CostTransformationModelReport.pdf>
- Chartered Institute of Management Accountants, CIMA. (2013). *Paper P3: Performance Strategy study text*. Berkshire, UK: Kaplan Publishing
- Chenhall, R. (2003). Management control systems design within its organisational context: Findings from contingency-based research and directions for the future. *Accounting, Organisation and Society*, 28, 127-168.
- Dittfeld, H., van Donk, D.P., & van Huet, S. (2022). The effect of production system characteristics on resilience capabilities: A multiple case study. *International Journal of Operations & Production Management*, 42 (13), 103-127. <https://doi.org/10.1108/IJOPM-12-2021-0789>
- Drazin, R., & Van de Ven, A.H. (1985). Alternative forms of fit in contingency theory. *Administrative Science Quarterly*, 30(4), 514-539. <https://www.jstor.org/stable/2392695>
- Geekiyana, D., & Ramachandra, T. (2020). Nexus between running costs and building characteristics of commercial buildings: Hedonic regression modelling. *Built Environment Project and Asset Management*, 10(3), 389-406. <https://doi.org/10.1108/BEPAM-12-2018-0156>
- Kolawole, Y. (2022). Contribution to economy: Manufacturing sector stagnates. <https://www.vanguardngr.com/2022/05/gdp-contribution-to-economy-manufacturing-sector-stagnates/>
- Kren, L., & Kerr, J. L. (1993). The effect of behaviour monitoring and uncertainty on the use of performance contingent compensation. *Accounting and Business Research*, 23(90), 159-167.
- Maelah, R., Auzair, S., Amir, A., & Ahmad, A. (2017). Implementation process and lessons learned in the determination of educational cost using modified activity-based costing (ABC). *Social and Management Research Journal*, 14(1), 1-32.
- Narver, J. C., & Slater, S. F. (1990). The effect of market orientation on business profitability. *Journal of Marketing*, 54, 20-35.
- Otley, D. T. (1980). The contingency theory of management accounting: Achievement and prognosis. *Accounting, Organizations and Society*, 5, 413-428.

- Otley, D. (2016). The contingency theory of management accounting and control: 1980–2014. *Management Accounting Research*, 31, 45–62. <https://doi.org/10.1016/j.mar.2016.02.001>
- Oyewo, B. (2022). Contextual factors moderating the impact of strategic management accounting on competitive advantage. *Journal of Applied Accounting Research*. <https://doi.org/10.1108/JAAR-04-2021-0108>
- Oyewo, B., Tawiah, V., & Zakari, A. (2022). Actualising Agenda 2030 through Sustainability Accounting: Evidence from the Nigerian Manufacturing Sector. (Advances in Environmental Accounting & Management, Vol. 10). <https://doi.org/10.1108/S1479-359820220000010006>
- Petera, P., & Šoljaková, L. (2020). Use of strategic management accounting techniques by companies in the Czech Republic. *Economic Research-Ekonomska Istraživanja*, 33(1), 46-67. <https://doi.org/10.1080/1331677X.2019.1697719>
- Phan, T.N., Baird, K., & Blair, B. (2014). The use and success of activity-based management practices at different organisational life cycle stages. *International Journal of Production Research*, 52 (3), 787-803. <https://doi.org/10.1080/00207543.2013.839893>
- Rogers, E.M. (2003). *Diffusion of innovations* (5th ed.). New York: The Free Press.
- Romanello, R., & Veglio, V. (2022). Industry 4.0 in food processing: Drivers, challenges and outcomes. *British Food Journal*, 124 (13), 375-390. <https://doi.org/10.1108/BFJ-09-2021-1056>
- Sands, J., Lee, K.-H. & Fonseka, K.B.M. (2016a). Advancing sustainability management accounting in the Asia Pacific region. *Accounting Research Journal*, 29(2), 134-136. <https://doi.org/10.1108/ARJ-03-2016-0035>
- Sands, J.S., Rae, K.N. & Gadenne, D. (2016b). An empirical investigation on the links within a sustainability balanced scorecard (SBSC) framework and their impact on financial performance. *Accounting Research Journal*, 29(2), 154-178. <https://doi.org/10.1108/ARJ-04-2015-0065>
- Schreiber, J. B., Nora, A., Stage, F. K., Barlow, E. A., & King, J. (2006). Reporting structural equation modelling and confirmatory factor analysis results: A review. *The Journal of Educational Research*, 99(6), 323–338. <https://doi.org/10.3200/JOER.99.6.323-338>
- Tabachnick, B. G. & Fidell, L. S. (2001). *Using multivariate statistics*. (4th ed.). Needham Heights, MA: Allyn & Bacon.
- Teng, J.T.C., Cheon, M.J., & Gover, V. (1995). Decisions to outsource information systems functions: Testing a strategy-theoretic discrepancy model. *Decision Science*, 16(1), 75-103.
- Vagnani, G., & Volpe, L. (2017). Innovation attributes and managers' decisions about the adoption of innovations in organizations: A meta-analytical review. *International Journal of Innovation Studies*, 1(1),107-133.
- Yap, K.H.A., Lee, T.H., Said, J., & Yap, S.T. (2013). Adoption, benefits and challenges of strategic management accounting practices: Evidence from emerging market. *Asia Pacific Management Accounting Journal*, 8(2), 27-45.

Zhao, Y., & Zhao, X. (2015). How a competing environment influences newsvendor ordering decisions. *International Journal of Production Research*, 54(1), 204-214. <https://doi.org/10.1080/00207543.2015.1034330>

Appendices

Appendix 1: Measurement of Variables

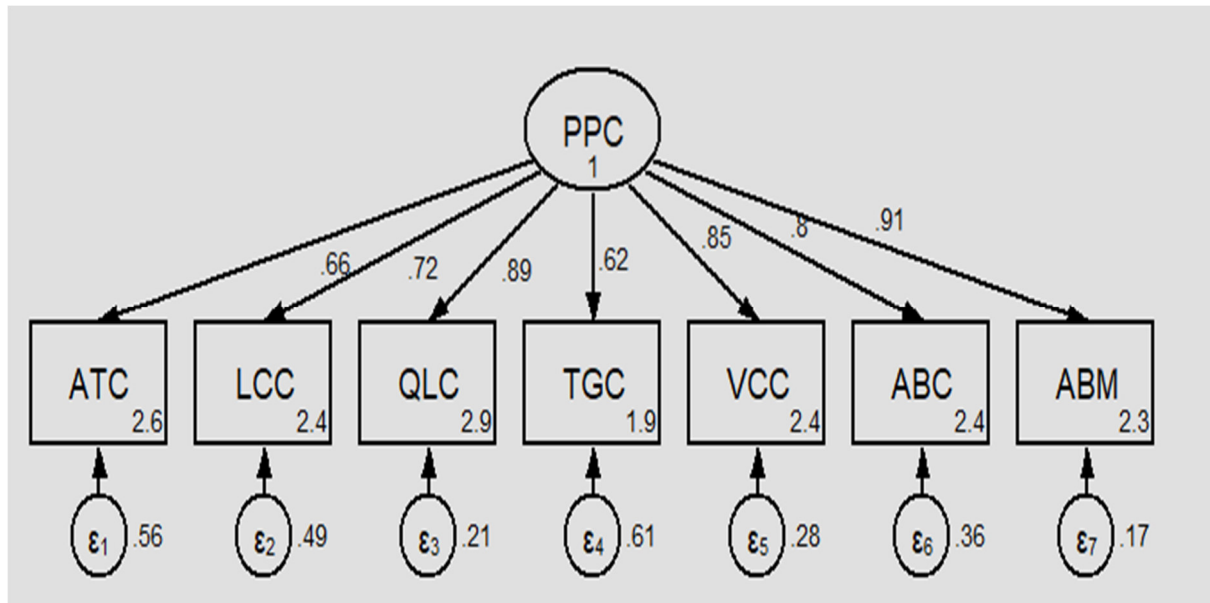
PANEL A: Operationalisation of Production Planning and Control Accounting Techniques			
Variable/ Acronym	Definition	Cronbach Alpha [KMO coefficient]	Source
Attribute costing (ATC)	The costing of specific product attributes that appeal to customers, such as operating performance variables; reliability, warranty arrangements, and after-sales service.	0.863 (0.827) ^{***}	Cadez & Guilding, 2012
Life cycle costing (LCC)	The appraisal of costs based on the length of stages of a product's life, including design, introduction, growth, maturity, decline and eventually abandonment.		
Quality costing (QLC)	Prioritising quality by identifying and controlling the costs associated with creating, identifying, repairing and preventing defects.		
Target costing (TGC)	A method used during product and process design that involves estimating a cost calculated by subtracting a desired profit margin from an estimated (or market-based) price. The product is then designed to meet that cost.		
Value-chain costing (VCC)	An activity-based approach where costs are allocated to activities required to design, procure, produce, market, distribute, and service a product or service.		
Activity-based costing (ABC)	A two-stage procedure is used to assign overhead costs to products. In the first stage, significant activities are identified, and overhead costs are assigned to activity cost pools based on how the activities consume the resources. In the second stage, overhead costs are allocated from each activity cost pool to each product line in proportion to the amount of the cost driver consumed by the product line.		
Activity-based management (ABM)	The use of information provided by an activity cost analysis (ABC) to improve organisational profitability.		
PANEL B: Measure of Contextual Factors and Organisational Competitiveness			
Variable/ Acronym	Definition	Cronbach Alpha [KMO coefficient]	Source
Organisational structure (STRC)	Degree of centralisation/decentralisation in the company on a scale of 1 (Not at all) to 5 (very large extent) 1. Level of power given to divisional managers /departmental Heads. 2. Level of independence accorded to branches/subsidiaries in making key decisions. 3. Degree to which responsibilities are shared to branches/subsidiaries.	0.883 (0.701) ^{***}	Self-developed

Quality of Information Technology (QIT)	Rating of information system on a scale of 1 (Very Low) to 5 (Very High): 1. Accuracy of information 2. Precision of information 3. Reliability of information 4. Completeness of information 5. Relevance of information to decision-making	0.960 (0.898)***	Teng, Cheon & Gover, 1995
Deliberate strategy-formulation (STRG)	Extent of agree or disagree with the following in respect of business strategy in the organization on a scale of 1 (Strongly Disagree) to 5 (Strongly Agree): 1. The strategic decision-makers usually think through everything in advance of strategic action 2. Strategic intentions are seldom realized with little or no deviation 3. Strategic action usually develops in the absence of strategic intention	0.725 (0.591)***	Cadez & Guilding, 2012
Market orientation (MKT)	Extent of market orientation in the company on a scale of 1 (Not at all) to 5 (To a very large extent): 1. My company has a strong understanding of our customers 2. The functions in my company work closely together to create superior value for our customers 3. Management in my organisation thinks in terms of serving the needs and wants of well-defined markets chosen for their long-term growth and profit potential for the company 4. My company has a strong market orientation	0.958 (0.743)***	Al-Mawali, 2015
Competition Intensity (CMPT)	Rating on intensity of market competition in the sector the company operates on a scale of 1 (Not intense at all) to 5 (Very intense)	<i>Not applicable</i>	Hansen & Van der Stede, 2004.
Perceived Environmental Uncertainty (PEU)	Predictability of the following stakeholders' actions on a scale of 1 (Very predictable) to 5 (Very unpredictable): 1. Customers 2. Suppliers 3. Competitors 4. Government	0.702 (0.615)***	Kren & Kerr, 1993
Organisational competitiveness (CAD)	Rating on how company performance compares with that of competitors over the past five years on a scale of 1 (far below average) to 5 (far above average) in the seven dimensions of: 1. Return on investment (ROI) 2. Margin on sales (MOS) 3. Capacity utilisation (CAP) 4. Customer patronage (CPT) 5. Product quality (PRQ) 6. Development of new products (NPD) 7. Market share (MKS)	0.921 (0.895)***	Cadez & Guilding, 2012

****p* value of Bartlett's Test significant at 1%

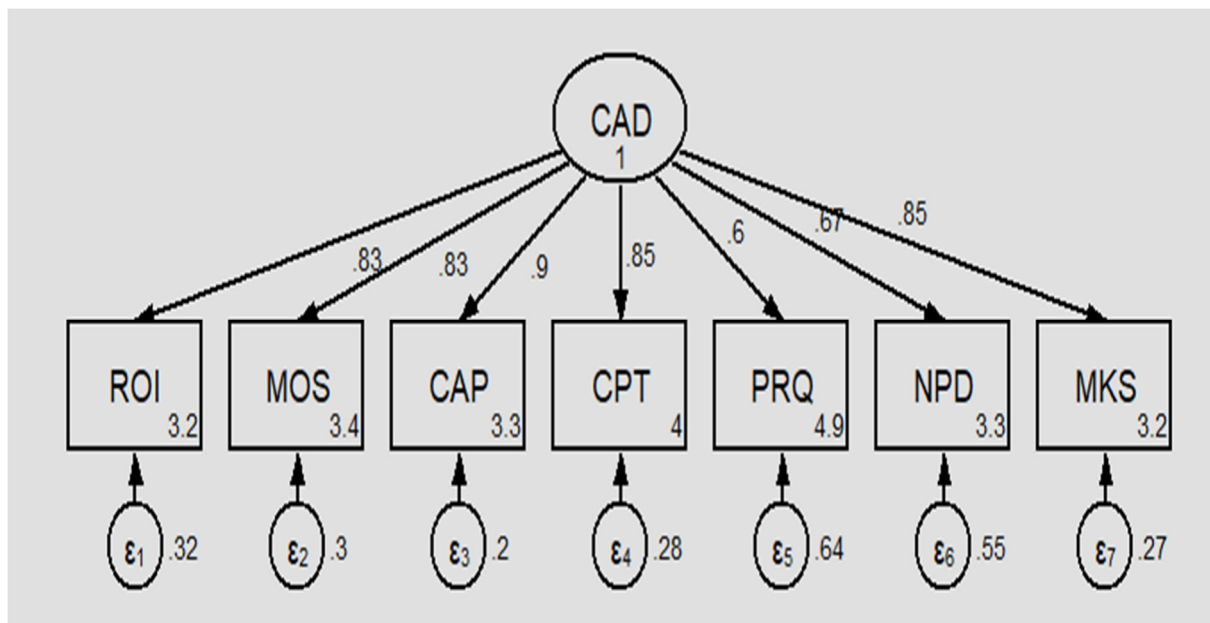
Source: Authors own creation

Appendix 2: Confirmatory Factor Analysis of Production Planning and Control Techniques (PPC)



Source: Authors own creation

Appendix 3: Confirmatory Factor Analysis of Organisational Competitiveness (CAD)



Source: Authors own creation

List of Tables

Table 1: Descriptive statistics on usage of PPC techniques

	Min	Max	Mean	Std Deviation
Attribute costing	1.000	5.000	3.070	1.195
Life cycle costing	1.000	5.000	2.980	1.252
Quality costing	1.000	5.000	3.470	1.198
Target costing	1.000	5.000	2.690	1.443
Value-chain costing	1.000	5.000	3.200	1.342
Activity-based costing	1.000	5.000	3.130	1.307
Activity-based management	1.000	5.000	3.240	1.401
Overall Mean			3.110	

Source: Authors own creation

Table 2: Descriptive statistics on contextual factors and firm attributes

Item	Min	Max	Mean	Std Dev.
<i>Contextual Factors</i>				
Organisational Structure (STRC)	1.670	5.000	3.155	0.903
Quality of Information Technology (QIT)	2.000	5.000	3.915	0.854
Deliberate Strategy-formulation (STR-DEL)	1.330	4.670	3.111	0.846
Market Orientation, MKT	2.000	5.000	3.894	1.042
Competition Intensity (CMPT)	2.000	5.000	4.000	1.044
Perceived Environmental Uncertainty (PEU)	1.250	4.500	2.922	0.724
<i>Firm-level Control Variables</i>				
Size (Sales in ₹ Million)	16	637,470	62,562	123,679
Return on Total Assets, ROA (%)	0.00	1660.130%	45.690%	246.26%
Market Presence, VALUE (Tobin's Q)	0.05	172.880	5.390	25.824

Source: Authors own creation

Table 3: Correlation matrix of independent variables

	STRC	QIT	STR-DEL	MKT	CMPT	PEU	SIZE	ROA	VALUE
STRC	1								
QIT	0.498**	1							
STR-DEL	0.416**	0.430**	1						
MKT	0.728**	0.746**	0.640**	1					
CMPT	0.522**	0.540**	0.642**	0.689**	1				
PEU	0.462**	0.197	0.360*	0.448**	0.390**	1			
SIZE	0.466**	0.507**	0.335*	0.514**	0.481**	0.332*	1		
ROA	-0.018	-0.043	0.050	0.028	0.014	-0.027	0.164	1	
VALUE	0.006	-0.014	0.090	0.054	0.020	-0.055	0.119	0.989**	1

** p < 0.05, and * p < 0.10 (two tailed)

Source: Authors own creation

Table 4: Structural equation analysis of determinants and impact of PPC on organisational competitiveness

Variables	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
PPC <-						
STRC	-0.012	0.101	-0.13	0.899	-0.211	0.186
QIT	0.185	0.115	1.60	0.109	-0.041	0.411
STRG	0.127	0.104	1.22	0.222	-0.077	0.333
MKT	0.424	0.139	3.04	0.002***	0.150	0.698
CMPT	0.088	0.085	1.03	0.304	-0.080	0.256
PEU	0.117	0.101	1.16	0.247	-0.081	0.315
SIZE (control)	0.093	0.075	1.23	0.217	-0.054	0.240
ROA (control)	0.001	0.002	0.54	0.591	-0.002	0.005
VALUE (control)	-0.007	0.019	-0.42	0.677	-0.045	0.029
-----+-----						
CAD <-						
PPC	0.812	0.181	4.49	0.000***	0.457	1.167
-----+-----						
Model Fitness Statistics:						
CMINDF ratio = $411.740 \div 193 = 2.133$ RMSEA $p = 0.001 \leq 0.05$ Prob > chi2 = 0.0000						
CFI = 0.701 TLI = 0.661 SRMR = 0.087 CD = 0.871						

*** p < 0.01

Source: Authors own creation

Table 5: Structural equation analysis of determinants and impact of PPC on organisational competitiveness with contextual factors linked as covariates

Variables	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
PPC <-						
STRC	-0.012	0.101	-0.13	0.899	-0.211	0.186
QIT	0.185	0.115	1.60	0.109	-0.041	0.411
STRG	0.127	0.104	1.22	0.222	-0.077	0.333
MKT	0.424	0.139	3.04	0.002***	0.150	0.698
CMPT	0.088	0.085	1.03	0.304	-0.080	0.256
PEU	0.117	0.101	1.16	0.247	-0.081	0.315
SIZE (control)	0.093	0.075	1.23	0.217	-0.054	0.240
ROA (control)	0.001	0.002	0.54	0.591	-0.002	0.005
VALUE (control)	-0.007	0.019	-0.42	0.677	-0.045	0.029
CAD <-						
PPC	0.812	0.181	4.49	0.000***	0.457	1.167
cov(STRC,QIT)	0.376	0.125	2.99	0.003***	0.129	0.622
cov(STRC,STRG)	0.311	0.120	2.58	0.010**	0.074	0.548
cov(STRC,MKT)	0.670	0.169	3.95	0.000***	0.337	1.003
cov(QIT,STRG)	0.304	0.114	2.65	0.008***	0.079	0.529
cov(QIT,MKT)	0.649	0.161	4.01	0.000***	0.332	0.967
cov(STRG,MKT)	0.552	0.152	3.62	0.000***	0.253	0.852
cov(CMPT,PEU)	0.288	0.118	2.44	0.015**	0.056	0.520
Model Fitness Statistics:						
CMINDF ratio = 411.740 ÷ 193 = 2.133 RMSEA p = 0.001 <= 0.05 Prob > chi2 = 0.0000						
CFI = 0.701 TLI = 0.661 SRMR = 0.087 CD = 0.871						

*** p < 0.01; ** p < 0.05

Source: Authors own creation

Table 6: Structural equation analysis of determinants and impact of PPC on organisational competitiveness using PPC index as an alternative measure of PPC

Variables	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
PPCI <-						
STRC	-0.079	0.142	-0.56	0.576	-0.358	0.199
QIT	0.180	0.158	1.13	0.257	-0.131	0.491
STRG	0.175	0.144	1.21	0.227	-0.108	0.459
MKT	0.481	0.176	2.73	0.006***	0.135	0.827
CMPT	0.225	0.118	1.90	0.057*	-0.006	0.458
PEU	-0.002	0.140	-0.02	0.988	-0.278	0.273
SIZE (control)	0.085	0.105	0.81	0.417	-0.120	0.291
ROA (control)	0.001	0.002	0.49	0.621	-0.004	0.007
VALUE (control)	-0.010	0.027	-0.37	0.709	-0.063	0.043
-----+-----						
CAD <-						
PPCI	0.560	0.105	5.32	0.000***	0.354	0.767
-----+-----						
Model Fitness Statistics:						
CMINDF ratio = $144.023 \div 83 = 1.735$ RMSEA $p = 0.001 \leq 0.05$ Prob > chi2 = 0.0000						
CFI = 0.825 TLI = 0.790 SRMR = 0.130 CD = 0.744						

*** p < 0.01, * p < 0.10

Source: Authors own creation

Table 7: Structural equation analysis on impact of individual PPC techniques on organisational competitiveness

Variables	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
CAD <-						
LCC	0.038	0.145	0.26	0.794	-0.247	0.323
QLC	0.313	0.142	2.20	0.028***	0.034	0.591
TGC	0.026	0.096	0.27	0.787	-0.162	0.214
VCC	-0.129	0.101	-1.28	0.202	-0.327	0.069
ABC	-0.049	0.122	-0.40	0.686	-0.289	0.190
ATC	-0.069	0.115	-0.61	0.544	-0.296	0.156
ABM	0.214	0.154	1.39	0.165	-0.088	0.516
SIZE (control)	0.351	0.100	3.50	0.00***	0.154	0.548
ROA (control)	-0.001	0.002	-0.15	0.883	-0.005	0.004
VALUE (control)	0.001	0.022	0.01	0.991	-0.044	0.044

*** p < 0.01

Source: Authors own creation

Table 8: Structural equation analysis on the impact of interactive use of PPC techniques on organisational competitiveness

Variables	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
CAD <-						
PPC	0.519	0.153	3.39	0.001***	0.219	0.819
SIZE (control)	0.310	0.100	3.11	0.002***	0.114	0.506
ROA (control)	-0.001	0.002	-0.25	0.803	-0.005	0.004
VALUE (control)	0.002	0.022	0.10	0.924	-0.042	0.046

*** p < 0.01

Source: Authors own creation

List of Figures

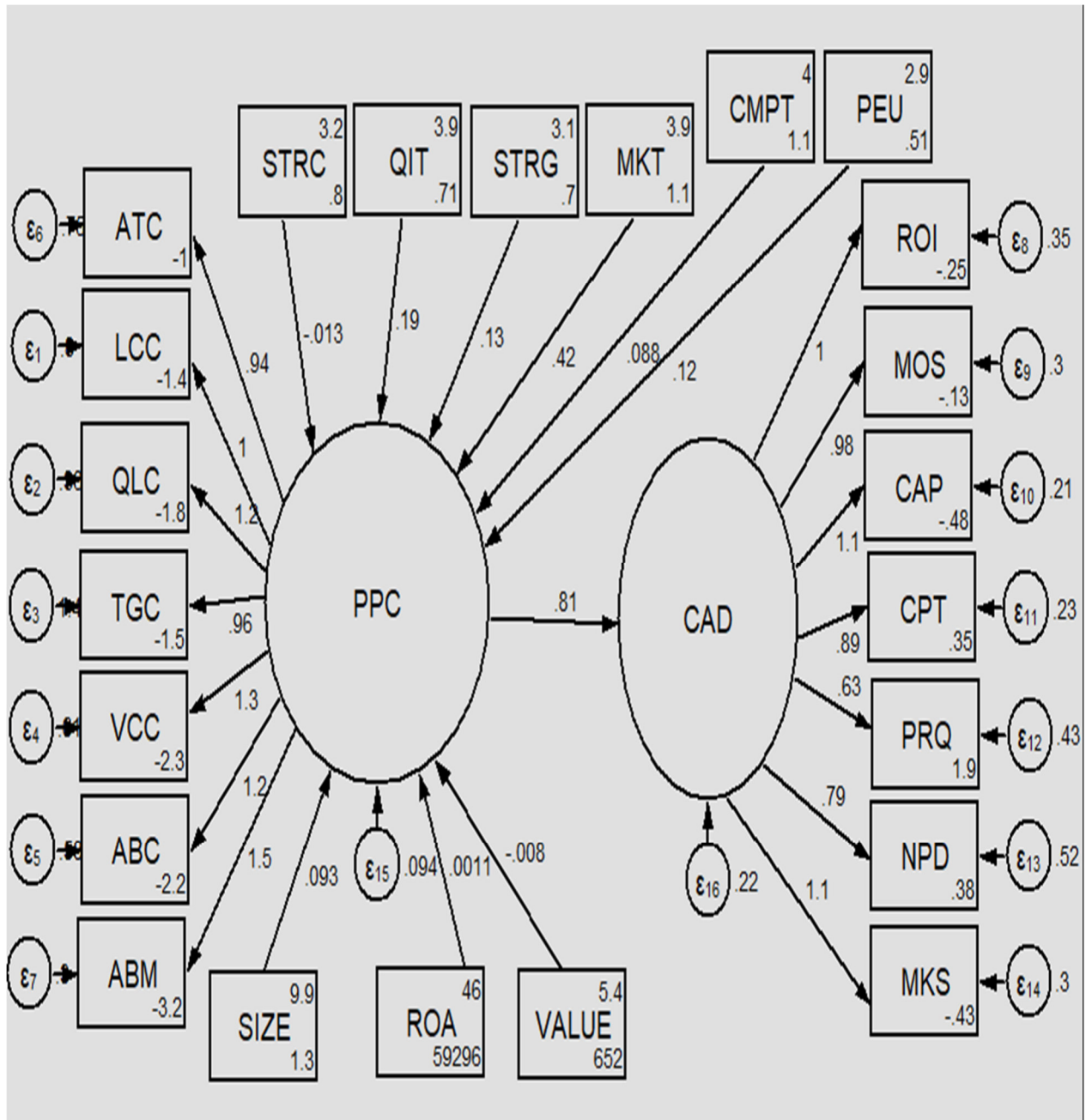


Figure 1: SEM diagram on determinants and impact of PPC on organisational competitiveness

Source: Authors own creation

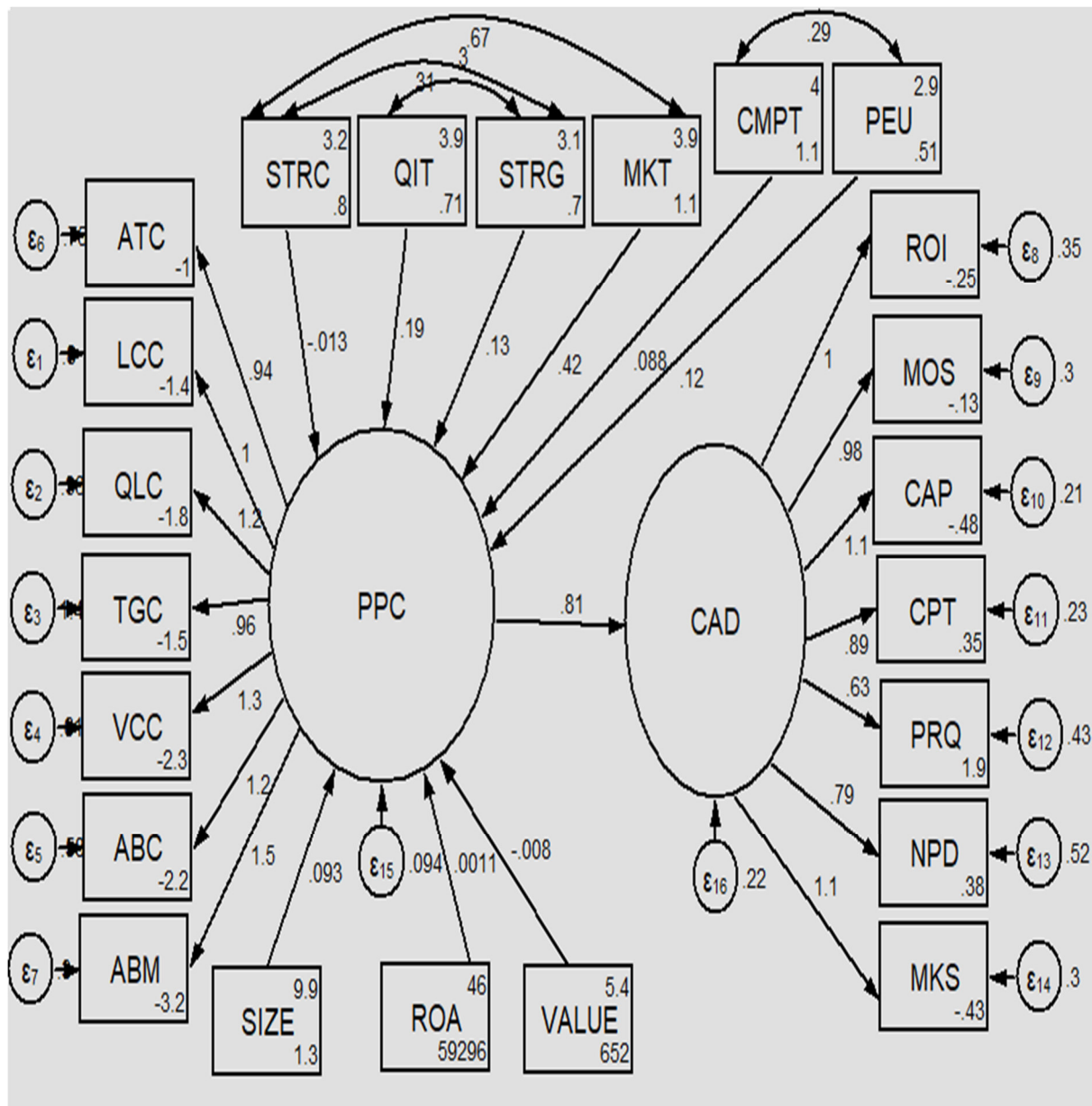


Figure 2: SEM diagram on determinants and impact of PPC on organisational competitiveness with contextual factors linked as covariates

Source: Authors own creation

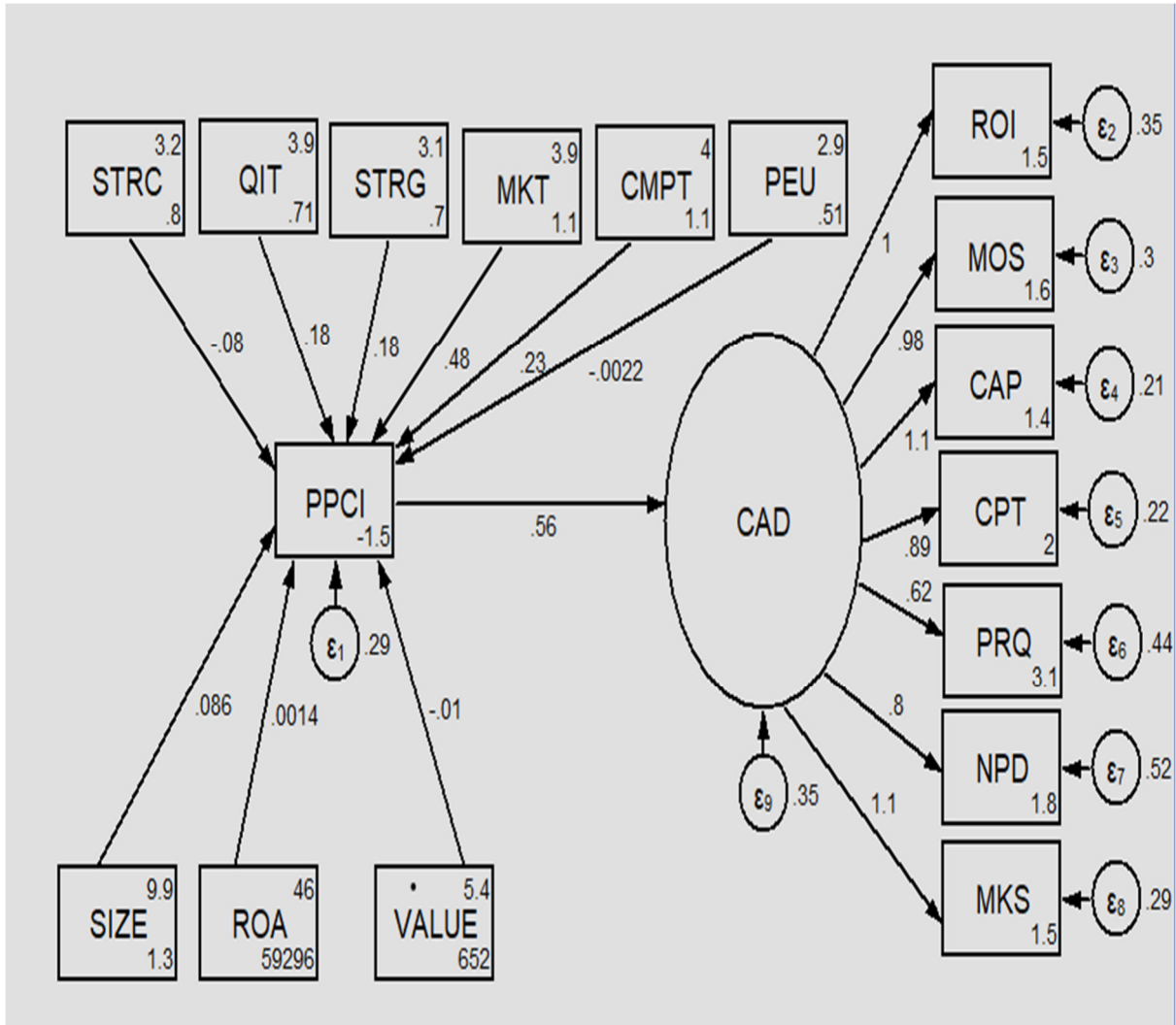


Figure 3: SEM diagram on determinants and impact of PPC on organisational competitiveness using PPC index as an alternative measure of PPC

Source: Authors own creation

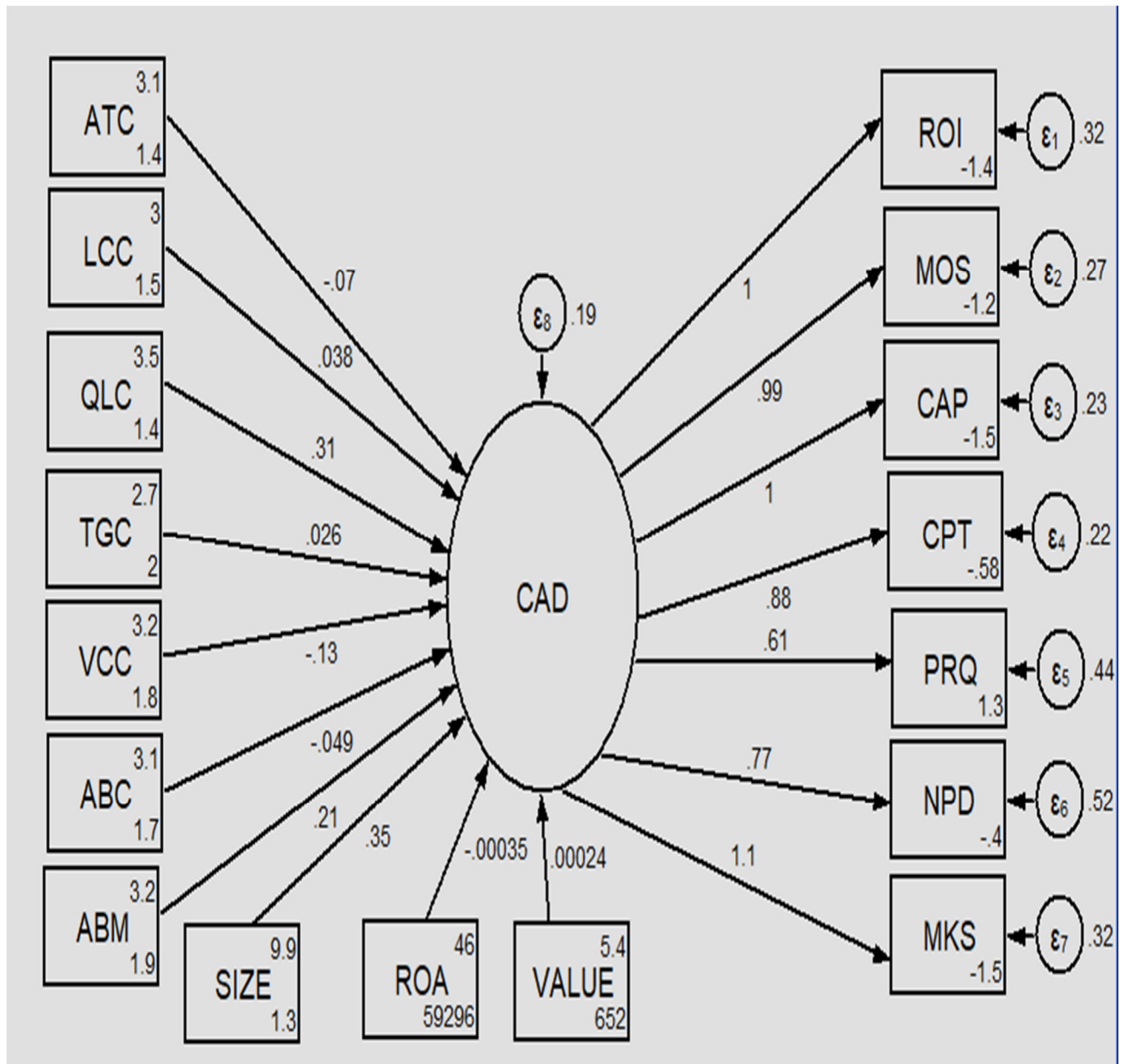


Figure 4: SEM diagram on impact of individual PPC techniques on organisational competitiveness

Source: Authors own creation

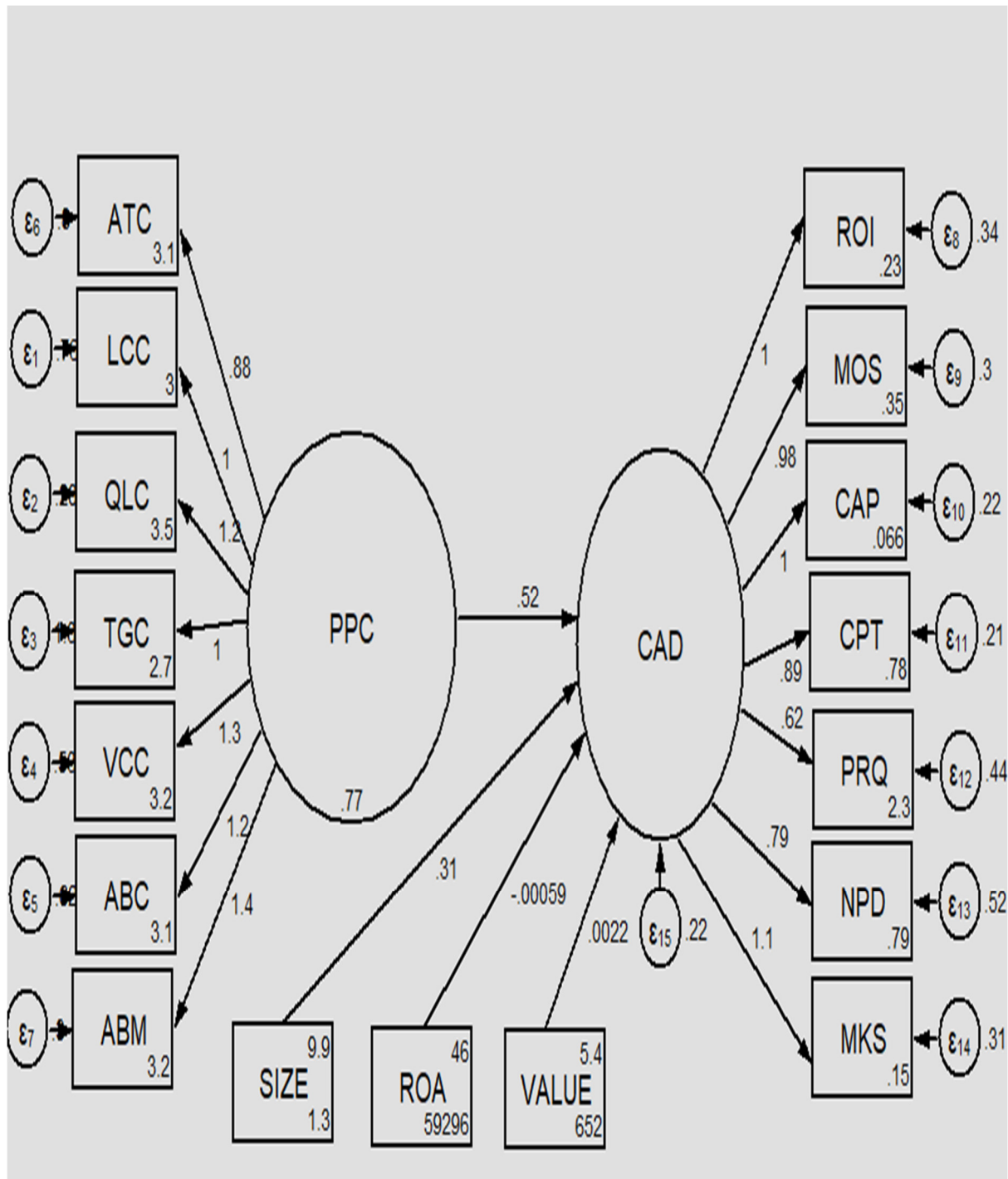


Figure 5: SEM diagram on impact of interactive use of PPC techniques on organisational competitiveness

Source: Authors own creation