Antecedents and performance outcomes of circular procurement: An empirical study in China

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Citation: Farooque, M., Zhang, A., Choi, T.-M., Hartley, J.L., Liu, Y., 2023. Antecedents and performance outcomes of circular procurement: An empirical study in China. Journal of Purchasing and Supply Management, 100882. https://doi.org/10.1016/j.pursup.2023.100882

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Abstract

Traditional procurement approaches and their prescribed business-as-usual practices are no longer sufficient in the face of society's grand environmental and resource challenges. In response, this research presents circular procurement, which is grounded in the circular economy (CE) philosophy, as a business-not-as-usual approach to firm and supply chain level purchasing decisions. Drawing on institutional theory and the practice-based view of strategy, a conceptual model is developed that maps the antecedents as well as performance outcomes of circular procurement practices in terms of the environmental and economic (i.e., cost and financial) dimensions of performance. Survey data from 255 Chinese manufacturers is then analyzed alongside qualitative data from two post-survey case studies to achieve better interpretation of survey results. The findings indicate that coercive pressures and integrated management systems (IMS) are key antecedents of circular procurement practices among Chinese manufacturers. Furthermore, circular procurement practices show a significant and positive effect on environmental, cost, and financial performance. Interestingly, the association between environmental performance and circular procurement is relatively weak in comparison to economic performance. This research provides empirical evidence of the performance outcomes of circular procurement and contributes to the literature by advancing our understanding of its theoretical foundations. It further provides important practical and policy guidelines that can help to enhance the development of circular procurement.

Keywords: Circular economy; Circular procurement; Green procurement; Sustainable procurement; Circular Supply Chain Management; Performance

Paper type: Research paper

1. Introduction

Over the last decades, the excessive consumption of natural resources around the globe has become a major concern for nations, governments, regulatory bodies, non-governmental organizations (NGOs), and firms. The manufacturing sector, one of the biggest consumers of natural resources, has long pursued sustainability in its operations in response to mounting pressure and criticism of the adverse environmental effects of its actions and activities (Kleindorfer et al., 2005; Van Wassenhove, 2019). In this endeavor, there is a growing consensus that transitioning to a circular economy (CE) can help to address resource scarcity (Farooque et al., 2019; Genovese et al., 2017; Van Wassenhove, 2019). Due to its strategic role in sourcing, acquiring organizational resources, and managing supplier relationships (Chen et al., 2004), procurement has a key role to play in circular supply chain management. However, traditional procurement practices are no longer sufficient to manage the current and future challenges arising from climate change and the depletion of natural resources, thus the need to pursue "business not as usual" (Knight et al., 2022; Walker et al., 2012).

"Circular procurement" has emerged as a promising new concept in the CE context, (Xu et al., 2022). It aims to transform supply chain practices from the linear (take, make and dispose) model to interconnected and closed energy and materials loops to minimize/avoid negative environmental impacts during the entire product life-cycle (European Commission, 2022). Circular procurement is narrower than both socially responsible procurement, which meets the ethical and voluntary expectations of society (Carter and Jennings, 2004; Hoejmose and Adrien-Kirby, 2012; Zorzini et al., 2015), and sustainable procurement, which covers all three dimensions of the triple bottom line (TBL) (Meehan and Bryde, 2011; Pagell et al., 2010; Schneider and Wallenburg, 2012). A large body of research has investigated green and environmental procurement practices (Green et al., 1998; Min and Galle, 2001; Tate et al., 2012; Zsidisin and Siferd, 2001). Such practices have some overlap with circular procurement

in their focus on reuse, recycling, and using fewer resources. However, circular procurement is more focused on the sourcing and use of materials that are natural, renewable, restorable or biodegradable, secondary and non-hazardous, specifically moving society toward the CE (European Commission, 2017; Farooque et al., 2022).

There is increasing interest in circular procurement at the policy as well as practice levels. For example, in 2017, the European Commission introduced and popularized circular public procurement as a terminology and concept denoting public procurement for a CE. Likewise, many leading global businesses have started circular procurement initiatives. For example, as part of its CE initiatives, IKEA has committed to only sourcing renewable or recycled materials by 2030 (IKEA, 2022). Similarly, Ralph Lauren has adopted a CE strategy that includes designing products for circularity, using 100% recycled cotton in its products and facilitating product resale and recycling (Ralph Lauren Corporation, 2021). However, despite this growing interest, little is known about the theoretical foundations of circular procurement and its operationalization in practice (Knight et al., 2022; Xu et al., 2022).

In this research, using institutional theory (DiMaggio and Powell, 1983) and the practice-based view (PBV) (Bromiley and Rau, 2014) as our theoretical lenses, we explore the antecedents of the development and implementation of circular procurement and examine its performance outcomes. Research shows that institutional factors (DiMaggio and Powell, 1983) influence firms' strategic choices and their operational practices, including traditional procurement practices (Lu et al., 2019; Nair and Prajogo, 2009; Zhu et al., 2013b). Thus, institutional pressures may also drive the development and implementation of circular procurement practices. The PBV of strategy suggests that firms' prior experiences of developing and implementing various firm-level performance practices enable them to identify and select new and better practices to enhance performance (Bromiley and Rau, 2014). Integrated management systems (IMS) including total quality management (TQM), lean

management, just-in-time (JIT) and management systems for quality (ISO 9001) and environment (ISO 14001) have resulted in operational improvements, superior performance and increasing sustainability over recent decades (Kleindorfer et al., 2005; Porter, 1996; Villena et al., 2021; Wang and Liu, 2023). Therefore, applying the PBV framework, multiple management systems, collectively termed IMS, may foster the development and implementation of circular procurement practices.

Supply chain sustainability research on the relationship of procurement practices to performance has shown promising results across the three dimensions of the TBL (Arora et al., 2020; Carter, 2005; Carter et al., 2000; Pagell et al., 2010). Because circular procurement is relatively new in the business arena, its performance outcomes have not been subjected to rigorous theoretical and empirical investigation. In light of this knowledge gap, our research aims to address two key questions:

1. What are the key antecedents of circular procurement practices at the firm level?
2. What is the impact of circular procurement practices on a firm's environmental and economic performance?

To address these research questions, we empirically examine the antecedents of circular procurement practices and their performance outcomes in the Chinese manufacturing context. In China, CE has been promoted as a national development strategy since its enactment in 2008 (Geng et al., 2019; Mathews et al., 2018). As a result, Chinese manufacturers have developed new practices (or modified their existing practices), such as circular procurement, as part of their CE implementation initiatives (Farooque et al., 2022; Khan et al., 2021; Zhang et al., 2021).

This study makes several original contributions. A recent editorial in the *Journal of Purchasing & Supply Management* highlights the lack of clarity on the theoretical foundations

of circular procurement and its operationalization in practice (Knight et al., 2022). Our research seeks to address this knowledge gap. Firstly, we attempt to deepen understanding of the internal and external antecedents of circular procurement practices. Secondly, we empirically test the relationship between circular procurement practices and firm performance using a survey of 255 Chinese manufacturers, followed by qualitative analysis of post-survey case studies for better interpretation of survey results. Overall, this study expands our understanding of circular procurement at the firm level and provides managerial guidance for developing and implementing circular procurement and its associated firm performance outcomes.

The remainder of this paper is organized as follows. Section 2 establishes the theoretical background and hypotheses. Section 3 outlines the research methodology. The research results are presented in section 4. Section 5 discusses the research findings and their theoretical, policy and practical implications. Section 6 concludes the research, discussing its limitations and future research directions.

2. Theoretical Background and Hypotheses Development

The interface between procurement and CE gained increased attention following the European Union's (EU) public procurement directives in 2014 (European Commission, 2014a, b) and the EU's first CE action plan, which was adopted in 2015 (European Commission, 2015). The European Commission defines circular procurement as "the process by which works, goods or services are purchased that seek to contribute to closed energy and material loops within supply chains, while minimizing, and ideally avoiding, negative environmental impacts and waste creation across their whole life-cycle" (European Commission, 2017, p.5). The EU's action plan recognizes public procurement as a key driver of the transition to the CE (European Commission, 2017). Similarly, the private sector also recognizes the integration of CE

principles in procurement practices, though it has received less research attention (Qazi and Appolloni, 2022).

Research specifically focused on circular procurement is still in its infancy. For example, Münch et al. (2022) examine supplier selection criteria in circular supply chains in the automotive industry, while Neessen et al. (2021) explore the characteristics of purchasing professionals and organizational factors in relation to implementing circular purchasing. They also suggest that external factors create constraints for circular procurement. A systematic literature review by Xu et al. (2022) reveals that researchers have explored internal and external antecedents of sustainable, green and circular procurement, with regulatory and normative institutional pressures identified as playing a role in all three contexts. Similarly, several benefits of implementing IMS (both internal and external to firms) have been identified (Bernardo et al., 2015; Simon et al., 2012; Wang and Liu, 2023), but its role remains unexplored in the context of circular procurement.

2.1 Antecedents of circular procurement

In order to gain a better understanding of the dynamics underpinning the adoption of circular procurement in Chinese manufacturing firms, this research aims to capture both the external and internal environmental influences leading to the implementation of circular procurement. In the following two sub-sections, we present our arguments and develop hypotheses on the antecedents of circular procurement practices using relevant theoretical lenses.

2.1.1 Institutional pressures as external antecedents of circular procurement

Institutional theory has been a dominant theoretical lens in studies exploring the influence of external pressures on organizational strategies and practices (Sancha et al., 2015). In the purchasing and supply management context, researchers have applied institutional theory to understand if and how institutional pressures influence the implementation of green and

sustainable purchasing practices (Green et al., 1998; Hsu et al., 2014; Min and Galle, 2001; Tate et al., 2012; Zsidisin and Siferd, 2001).

According to DiMaggio and Powell (1983), institutional pressures encompass three distinct dimensions: coercive, mimetic, and normative. *Coercive pressures* are "both formal and informal pressures exerted on organizations by other organizations upon which they are dependent, and by cultural expectations in the society within which the organizations function" (DiMaggio and Powell 1983, p. 150). *Mimetic pressures* are exerted when firms model themselves on other organizations they perceive to be more legitimate or successful (DiMaggio and Powell, 1983). Finally, *normative pressures* are exerted primarily by professionalization, which refers to "the collective struggle of members of an occupation to define the condition and methods of their work, to control the production of producers and to establish a cognitive base and legitimation of their occupational autonomy" (DiMaggio and Powell 1983, p. 152). Note that these three dimensions of institutional pressures are distinguished by their nature, not their sources. A stakeholder may exert more than one type of institutional pressure. For example, a government can exert coercive pressure through legislation and regulations that must be complied with and can also exert normative pressure by promoting non-compulsory practices. A major customer can also impose coercive pressure on suppliers to implement environmental practices as a condition for future business, and by influencing industry best practices to create normative pressures for suppliers.

Studies have found that coercive pressures can arise from government regulations and policies, dominant customers or suppliers, and due to competitive necessity within an industry or market segment (Guler et al., 2002; Kauppi and Luzzini, 2022; Liang et al., 2007). Similar findings are reported in the purchasing and supply management context (Zsidisin et al., 2005). Furthermore, Min and Galle (2001) suggest that regulations are drivers of green purchasing practices. The role of government incentives and regulations in the adoption of green and

circular procurement practices is also identified by Xu et al. (2022) in their systematic literature review. Downstream organizations such as distributors, retailers, and customers have also been shown to drive the adoption of environmental purchasing practices (Carter and Carter, 1998).

In the Chinese context, there are governmental regulations and policies around CE. The Chinese government, through coercive mechanisms, has been aggressively implementing the CE at the macro (i.e., national/regional/city), meso (i.e., eco-industrial parks), and micro (i.e., firm or supply chain) levels. Such coercive regulations compel organizations to comply to avoid the repercussions of non-compliance (Camisón, 2010). Moreover, previous research has also shown that market pressures, specifically from foreign and export customers, can significantly impact the environmental orientation of Chinese manufacturing firms (Zhu and Sarkis, 2007). Thus, using insights from the institutional theoretical perspective, we maintain that Chinese manufacturing firms are likely to be influenced by coercive pressures to adopt circular procurement practices. Based on these arguments, we hypothesize that:

> **H1a**: Coercive pressures positively affect the adoption of circular procurement practices.

According to DiMaggio and Powell (1983), mimetic isomorphism often occurs in situations with high uncertainty due to a poor understanding of organizational technologies, goal ambiguity, and other environmental factors. As a result, organizations benchmark the successful strategies of other firms seen as industry leaders (Kauppi, 2013). Likewise, in the purchasing and supply management context, organizations can transplant methods successfully applied by other firms to manage uncertainty associated with the supply of materials (Zsidisin et al., 2005).

In the Chinese context, Zhu and Sarkis (2007) report that increased competition from domestic and foreign competitors has forced manufacturers to learn and implement cost-efficient environmental management practices. However, as explained earlier, circular

procurement practices require a "business not as usual" approach to purchasing that may be less familiar to many firms. Therefore, from an institutional theory perspective, firms are likely to copy the actions and practices of so-called green and social champions (Sancha et al., 2015) as a way to implement circular procurement. Based on these arguments, we hypothesize the following:

> **H1b**: Mimetic pressures positively affect the adoption of circular procurement practices.

Normative pressures emerge from values and behavioral standards promoted by well-established professional bodies (Tate et al., 2011). In turn, organizations (including their actions and practices) conforming to these shared norms are perceived as more legitimate (Sarkis et al., 2011). In the purchasing and supply management context, such pressures can emerge from organizations such as the Institute for Supply Management and the International Purchasing and Supply Education and Research Association (Zsidisin et al., 2005). Furthermore, a recent literature review by Xu et al. (2022) identifies normative pressures as an antecedent of green and circular procurement.

Normative pressures for the adoption of CE are exerted by the Chinese government and industry, as well as professional associations such as the China Association of Circular Economy (CACE). Moreover, previous research has found that widely accepted norms (for example, traditional green and sustainable purchasing practices as noted in earlier sections) among supply chain members (such as customers and suppliers) also drive environmentally conscious practices (Kauppi and Luzzini, 2022; Liang et al., 2007). Thus, from an institutional theory perspective, we infer that Chinese manufacturing firms are likely to adopt circular procurement practices driven by normative pressure to be perceived as legitimate and professional in handling their responsibilities. Given these arguments, we hypothesize the following:

H1c: Normative pressures positively affect the adoption of circular procurement practices.

2.1.2 IMS as internal antecedents of circular procurement

The PBV of strategy suggests that a variety of factors influence and/or facilitate firms to adopt new practices (Bromiley and Rau, 2014, 2016). Previous studies have used the PBV framework to demonstrate how firms' execution of various practices is facilitated by explanatory factors in the form of antecedents or enablers (Kosmol et al., 2019; Wang et al., 2018). We rely on the PBV for possible explanations of internal factors that play an antecedent role in the adoption of circular procurement. However, we limit our focus to the role of management systems as this aspect remains largely unexplored in the context of circular procurement. According to the PBV, some organizations have systems, for example, TQM, that search for continuous improvement opportunities (Bromiley and Rau, 2014, 2016). In this regard, past research suggests that quality management systems such as TQM and/or ISO 9000 have been key enablers in fostering the development of many green supply chain practices (Zhu and Sarkis, 2004), including environmental purchasing (Carter and Carter, 1998). The PBV also recognizes that firms and managers use their prior knowledge of, and experience with such systems when seeking to adopt new and better practices (Bromiley and Rau, 2014, 2016). For example, Kleindorfer et al. (2005) found that aspirations underlying ISO 14000 implementation were generally motivated by firms' prior experience with ISO 9000. Thus, from a PBV of strategy, it is quite reasonable to argue that IMS, which refers to multiple management systems including TQM, Lean/JIT programs, and ISO serial certificates (i.e., ISO 9001 and 14001), is likely to serve as an antecedent of circular procurement practices at the firm level. For example, TQM can help reduce waste created by quality problems, and lean/JIT practices can help reduce waste from various sources. ISO serial certifications, especially ISO 14001, have long served as a tool for the management and control of firm-level environmental impacts. Thus, firms with

experience using IMS should be better positioned to adopt CE-oriented firm and supply chain level practices. We therefore hypothesize that:

> **H2:** Firms' prior experience with IMS enhances the adoption of circular procurement practices.

2.2 The relationship of circular procurement practices to firm performance

The PBV of strategy primarily aims to explain variations in firm performance based on practices a variety of firms might adopt that are imitable, publicly available, and transferable across firms (Bromiley and Rau, 2014, 2016). Circular procurement practices are well aligned with the PBV, with governments and other relevant stakeholders widely publicizing the concept of circular procurement as part of the CE program. Specifically, in the Chinese context, CE has been promoted as part of the national development strategy for about two decades. Indeed, the extant literature reports that firms have adopted various practices, including circular procurement, as part of their transition to a CE (Farooque et al., 2022; Ghisellini et al., 2016; Khan et al., 2021).

Several studies within the supply chain sustainability domain indicate a positive relationship between purchasing practices and firm performance across the three dimensions of the TBL (Arora et al., 2020; Carter, 2005; Carter et al., 2000; Pagell et al., 2010). Historically, green (including environmental) and sustainable purchasing practices have contributed to improving the environmental performance of supply chains (Brewer and Arnette, 2017; Green et al., 1998; Schoenherr et al., 2014; Yook et al., 2018). Circular procurement, which promotes using non-virgin materials and eliminating waste from the product-system throughout the product lifecycle (European Commission, 2022; Farooque et al., 2022) is also seen to enhance the environmental benefits for firms. In a recent study, Ntsondé and Aggeri (2021) found that a public tender for circular furniture in Denmark resulted in direct and indirect environmental impacts. Similarly, online/digital material and waste

exchange platforms, which promote circular procurement, can contribute to environmental value creation through innovative approaches to material reuse and waste recovery (Dhanorkar, 2019; Dhanorkar et al., 2015). One example includes digital circularity brokerage in food supply chains that bridges the missing linkages between waste generators and potential receivers (Ciulli et al., 2020). Given this supporting evidence, this research hypothesizes that:

> **H3:** Adoption of circular procurement practices improves the environmental performance of firms.

According to Van Wassenhove (2019), maintaining profitable growth remains a fundamental agenda for commercial companies as they cannot afford to trade off economic returns for environmental or social benefits. From this perspective, companies will only engage in activities such as circular procurement practices if they are economically attractive. Although the economic performance of sustainability-led purchasing practices remains debated in the academic literature, some recent research work has reported positive effects in terms of cost and financial performance (see for example, Arora et al. (2020); Song et al. (2017); Yook et al. (2018)). We argue that because circular procurement aims to substitute the use of virgin resources with those gathered through recirculation and restoration of the existing material base, the acquisition of circular materials opens up new revenue streams, lower disposal costs, and can bring about substantial potential savings (Geng et al., 2019). Given these arguments, we propose the following hypotheses:

> **H4:** Adoption of circular procurement practices improves the cost performance of firms.
>
> **H5:** Adoption of circular procurement practices improves the financial performance of firms.

Figure 1 summarizes the hypotheses discussed above in a conceptual model. We have controlled for the effect of firm size, ownership type and industry. It is widely acknowledged in the extant literature that large organizations often have better access to the resources required to implement new organizational practices (Zhu and Sarkis, 2004). Thus, large firms may be better positioned than their smaller counterparts to adopt CE practices such as circular procurement. Ownership type is also known to affect the implementation of sustainability-led practices, especially in the Chinese context (Li and Zhang, 2010). For example, state-owned enterprises, which represent the majority of manufacturing firms in China, receive support and assistance to implement CE (Geng et al., 2009), though this support comes with additional governmental pressure (Li and Zhang, 2010). Similarly, foreign owned firms often proactively implement sustainability practices in their supply chains (Zhu and Geng, 2013). Furthermore, the extent of CE implementation also varies by industry type, with some industries having more circularity-led initiatives than others for various reasons. For example, the complexity as well as cost of resource recovery procedures can vary significantly across industries (Van Wassenhove, 2019). Industry norms and culture around only purchasing virgin raw materials can also hinder the implementation of circular procurement practices in some industries (Qazi and Appolloni, 2022).

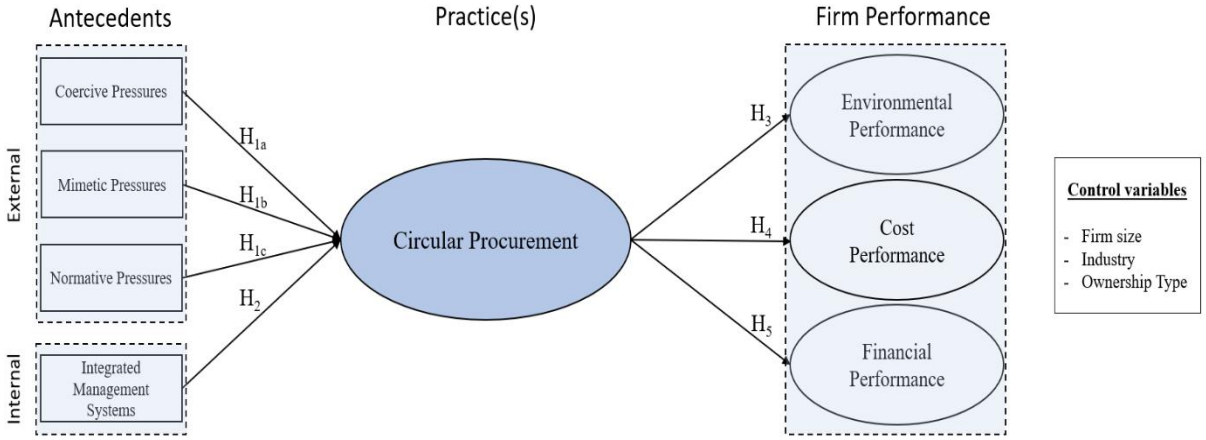


Figure 1: Conceptual Model

3. Research Methodology

3.1 Sample and data collection

We collected data for this research in mid- 2019 as part of a large survey focused on CE adoption in the Chinese manufacturing industry. Using a convenience sampling approach, the questionnaires were distributed to manufacturing firms across the six Chinese administrative regions through multiple channels, including professional associations, postgraduate/MBA/EMBA students and alumni, and local government officials. Survey questionnaires were distributed equally between manufacturing firms located inside and outside of an eco-industrial park (EIP). (Note: The Chinese government has strategically developed EIPs to achieve sustainable industrial development and CE goals (Geng et al., 2019; Mathews et al., 2018). However, a vast majority of manufacturing firms still operate outside these EIPs. Moreover, the CE legislation applies to all firms; irrespective of their location.) Our sampling approach is appropriate and justifiable in the context of China, where central government exercises tight control over businesses through its legislative and regulatory mechanisms. Also, our sampling approach is in line with previous studies (Zhu et al., 2011; Zhu and Sarkis, 2004) that have employed non-random sampling methods given the challenges of collecting survey data related to organizational-level practices in the Chinese manufacturing sector.

3.2 Questionnaire development

A comprehensive review of relevant literature was conducted to develop the survey questionnaire. Construct measures were adapted from the literature. Specifically, for institutional pressures we focused on the social aspect, adapting measures from the seminal work of Liang et al. (2007) and Zhu et al. (2013b). Coercive pressure was measured in terms of the informal and formal pressures perceived by firms from government regulations, customers (including both domestic and foreign customers), and competitive conditions.

Mimetic pressure was operationalized as the extent to which competitors are perceived to have benefitted from CE practices. Normative pressure was measured in terms of the extent to which channel members such as suppliers and customers have adopted CE practices, and the extent to which government, industry and professional associations promote CE practices.

We devised a reflective scale for the IMS construct based on the insights drawn from seminal work by Porter (1996). The extent of IMS implementation was measured using four items derived from Villena et al. (2021) and Zhu and Sarkis (2004). The items measuring circular procurement were adapted from previous empirical studies, including Carter and Carter (1998), Zhu et al. (2010, 2011), Zhu et al. (2013a) to reflect circularity principles in the procurement function. The construct measured the extent of adoption of circular procurement practices in the last year.

Firm performance was operationalized using a scale adapted from previous empirical studies for the following performance dimensions: environmental (Yang et al., 2013; Zhu et al., 2011; Zhu and Sarkis, 2004), cost (Zhu et al., 2011; Zhu and Sarkis, 2004), and financial performance (Flynn et al., 2010). The respondents were asked to evaluate their firm's performance across the three dimensions in the current year compared to their main competitor in the industry.

Because our target respondents were based in China, the questionnaire was translated into Chinese by two native Chinese researchers who were fluent in both Chinese and English. Furthermore, a back-translation technique was used to ensure the measures in the Chinese questionnaire were conceptually equivalent to the English version (Paulraj et al., 2017). We ran two rounds of pilot tests, with each round involving seven senior managers from large-scale manufacturers in face-to-face meetings. Participants provided detailed feedback on the questionnaire design in relation to the wording of measures and led to certain measures being

added/removed in the final questionnaire. This process improved the questionnaire by ensuring content validity and increasing clarity.

The questionnaire was divided into two parts. Part I included questions on the control and dependent variables (i.e., firm performance). A seven-point Likert scale (1 = significantly lower; 7 = significantly higher) was used for items measuring firm performance. Part II included questions on institutional pressures, IMS, and circular procurement practices. For mimetic and coercive pressures, we used a five-point Likert scale, with 'strongly disagree' (1) and 'strongly agree' (5) as the scale anchors, while normative pressures were anchored at 'none' (1) and 'high' (5), following Liang et al. (2007). For IMS and circular procurement practices, the scales were anchored at 'not at all' (1) and 'to full extent' (5). The main components of the survey questionnaire are provided in Appendix A.

3.3 Survey administration

A split survey method (Dubey et al., 2015; Podsakoff et al., 2003) was used to elicit responses from two individuals within an organization. The questionnaire was divided into two parts. Part I requested a response from a senior manager who was well-informed about overall firm performance. Part II requested a response from a senior manager familiar with the firm's operations. However, due to the inherent challenges of managing a matched response questionnaire survey and taking into account sample size considerations, we also allowed a single respondent to complete the entire questionnaire in cases where recruiting two respondents within the organization was not possible.

In total, 930 questionnaires were distributed, and we received 360 completed responses (38.7% response rate). All the responses received were subjected to several checks to ensure data quality. This exercise resulted in 105 responses being rejected for reasons including response to screening questions, straight-lining and missing information. Therefore, the results

are based on 255 responses. Note, in the final sample of 255 responses, 75 (29.4%) were matched responses, and 180 (70.6%) were completed by a single respondent. Furthermore, 103 (40%) of the firms operated inside and 152 (60%) outside an EIP. Detailed sample demographics are presented in Table 1.

Table 1: Sample demographics

Variable	Frequency	Percentage (%)
Firm Size (No. of employees)		
Size 1: < 100	50	19.6%
Size 2: 101–500	82	32.2%
Size 3: 501-1000	39	15.3%
Size 4: 1001-3000	37	14.5%
Size 5: 3001-8000	22	8.6%
Size 6: > 8001	25	9.8%
Ownership Type		
Type 1: State owned	126	49.4%
Type 2: Collective	66	25.9%
Type 3: Private	36	14.1%
Type 4: Foreign owned	21	8.2%
Type 5: Joint venture	5	2.0%
Type 6: Others	1	0.4%
Industry		
Industry 1: Metals/Metal product/Machinery/Equipment	73	28.6%
Industry 2: Metallurgy	23	9.0%
Industry 3: Chemicals	20	7.8%
Industry 4: Automotive/Transport equipment/Vehicle	19	7.5%
Industry 5: Electrical appliances/Household appliances	19	7.5%
Industry 6: Pharmaceutical/Treatment	15	5.9%
Industry 7: Food/Beverage/Wine/Tobacco	13	5.1%
Industry 8: Building material/ Building & decorative	11	4.3%
Industry 9: Coke/Petroleum	10	3.9%
Industry 10: Electronics/Communication	9	3.5%
Industry 11: Textile/Apparel/Leather	6	2.4%
Industry 12: Rubber/Plastics	6	2.4%
Industry 13: Others	31	9.0%
Role of firm		
Role 1: Raw-material supplier	34	13.3%
Role 2: Component supplier	37	14.5%
Role 3: Original equipment manufacturer	159	62.4%
Role 4: Contract manufacturer	25	9.8%
Firm sales		
Sales 1: < 1 million RMB	2	0.8%
Sales 2: 1-4.9 million RMB	7	2.7%
Sales 3: 5-9.9 million RMB	11	4.3%
Sales 4: 10-49.9 million RMB	38	14.9%
Sales 5: 50-99.9 million RMB	15	5.9%
Sales 6: 100-499.9 million RMB	64	25.1%
Sales 7: 500-999.9 million RMB	31	12.2%
Sales 8: 1-4.9 billion RMB	40	15.7%
Sales 9: 5-9.9 billion RMB	18	7.1%
Sales 10: > 10 billion RMB	29	11.4%
Designation (Management Level)		
Level 1: Top Managers	44	17.3%
Level 2: Middle Managers	161	63.1%
Level 3: Junior Managers	50	19.6%
Total	255	100.0%

3.4 Non-response bias

We tested for non-response bias by comparing the early and late waves of responses. The early and late responses were compared using two-tailed *t*-statistics. The *t*-tests yielded no statistically significant differences among any of the variables used in the study. Thus, we concluded that non-response bias does not present a major concern.

3.5 Common method bias

We employed several procedural and statistical techniques following recommendations by Podsakoff et al. (2003), Podsakoff et al. (2012) for minimizing common method bias (CMB). First, we designed an anonymous and self-administered survey. Secondly, we employed a split survey method intending to elicit responses from two individuals per organization. Thirdly, we employed several variations in questionnaire design and presentation to avoid CMB and social desirability issues. For example, we used organization as the proxy subject (Nederhof, 1985; Pullman et al., 2009) when referring to circular procurement practices. Similarly, a time interval of one year was maintained between practices and performance measures. Different measurement scales were also used throughout the questionnaire to avoid straight-lining response behavior. Lastly, we used a seven-point Likert scale for items measuring firm performance (i.e., dependent variable) to provide increased capability for detecting social desirability bias (Stöber et al., 2002).

Despite our efforts, the final sample consists of a large number of responses collected from a single source (approx. 70%), so CMB may still be present (Guide Jr. and Ketokivi, 2015). We used three statistical techniques to detect the presence of CMB and determine the severity of its potential negative effects on our survey results. First, Harman's single-factor test (Harman, 1976) was conducted, with only 19.8% of the variance explained by the first factor. Second, we ran a common latent factor test (Podsakoff et al., 2003; Podsakoff et al., 2012); however, no significant improvement in model fit was noted in measurement models with and

without a common latent factor. This was further confirmed by a third statistical test following Widaman's (1985) approach, which compares a measurement model with traits only to another model that includes a method factor in addition to the traits. Our results indicated no significant improvement in model fit using the CFI change criterion (at a cutoff point of ± 0.01) (Cheung and Rensvold, 2002). Taken together, these test results suggest that CMB is unlikely to be of concern in our survey.

3.6 Construct validity and reliability

Table 2 shows the results for construct validity and reliability. All Cronbach's alpha values are above 0.7, indicating acceptable internal consistency across constructs (Hair et al., 2006). The Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) scores exceed 0.7 for all parts of the questionnaire, while the Bartlett test of sphericity (BTS) results show high significance (p-value <0.001). This indicates the data could be reliably tested using factor analysis. Exploratory factor analysis (EFA) was performed using principal component analysis with varimax rotation (see Table 2 for details). Furthermore, convergent and discriminant validity were established using confirmatory factor analysis (CFA). Convergent validity was first established by examining the factor loadings: all being greater than 0.5 (Hair et al., 2009); see Table 2. Moreover, except for three variables, the average variance extracted (AVE) values are all above 0.5, as shown in Table 3. Given the multi-dimensional scope of this study, which attempted to examine antecedents and performance aspects of an emerging concept and practice (circular procurement), the AVE values above 0.4 are considered acceptable (Prajogo et al., 2021). Discriminant validity is also established as all the square-rooted AVE values are greater than the correlations between constructs, as shown in Table 3 (bold numbers in diagonal).

Table 2: Measurement Validity and Reliability

Construct/Variable	Items	Factor Loadings		Cronbach's α
		EFA	CFA	
Practice(s)	**KMO** = 0.79, **BTS** (1115.19; p<0.00), **Cumulative Variance (%)** = 55.99			
Circular Procurement	CPR1	0.57	0.55	0.83
	CPR2	0.68	0.59	
	CPR3	0.81	0.64	
	CPR4	0.81	0.77	
	CPR5	0.75	0.77	
	CPR6	0.73	0.71	
Integrated Management Systems	IMS1	0.78	0.66	0.73
	IMS2	0.76	0.65	
	IMS3	0.78	0.73	
	IMS4	0.66	0.59	
Institutional Pressures	KMO = 0.79, **BTS** (831.01; p<0.00), **Cumulative % of Variance** = 68.08			
Coercive Pressures	COER1	0.77	0.65	0.71
	COER2	0.81	0.71	
	COER3	0.63	0.65	
Mimetic Pressures	MIMT1	0.87	0.80	0.87
	MIMT2	0.84	0.86	
	MIMT3	0.85	0.83	
Normative Pressures	NORM1	0.75	0.57	0.80
	NORM2	0.74	0.50	
	NORM3	0.77	0.87	
	NORM4	0.76	0.81	
Firm Performance	**KMO** = 0.87, **BTS** (3560.27; p<0.00), **Cumulative % of Variance** = 75.17			
Cost Performance	CP1	0.78	0.82	0.86
	CP2	0.82	0.88	
	CP3	0.80	0.79	
	CP4	0.75	0.56	
	CP5	0.74	0.52	
Environmental Performance	EP1	0.85	0.82	0.93
	EP2	0.89	0.89	
	EP3	0.90	0.91	
	EP4	0.87	0.83	
	EP5	0.83	0.76	
Financial Performance	FP1	0.83	0.76	0.94
	FP2	0.91	0.92	
	FP3	0.93	0.95	
	FP4	0.92	0.96	
	FP5	0.88	0.88	
	FP6	0.75	0.65	

Table 3: Correlations and Model Validity Statistics

	M	SD	CR	AVE	1	2	3	4	5	6	7	8
1. Environmental Performance	5.15	0.97	0.72	0.72	**0.85**							
2. Cost Performance	4.37	0.76	0.85	0.53	0.29*	**0.73**						
3. Financial Performance	4.28	1.17	0.94	0.75	0.19*	0.41**	**0.86**					
4. Circular Procurement Practices	3.22	0.90	0.83	0.45	0.03	0.15*	0.29**	**0.67**				
5. Integrated Management Systems	4.13	0.87	0.76	0.44	0.24*	0.07	0.20*	0.26*	**0.66**			
6. Coercive Pressures	3.53	0.84	0.71	0.47	0.17	0.04	0.06	0.40**	0.32**	**0.67**		
7. Mimetic Pressures	3.49	0.86	0.87	0.69	0.03	-0.06	0.05	0.24**	0.15	0.58**	**0.83**	
8. Normative Pressures	3.39	0.85	0.78	0.51	0.15*	0.01	0.12	0.19*	0.19*	0.62**	0.39**	**0.70**

* $p < 0.05$
** $p < 0.01$
Note(s): Likert scale (5-points for IVs and 7-points for DVs) were used for measurement purposes.

To demonstrate goodness-of-fit of the measurement model, we report the most commonly used model fit indices. First, we obtained the chi-square statistic ($\chi 2$), which indicates the difference between the estimated covariance matrix and the covariance matrix derived from the data. The $\chi 2$ of our model = 967.67 with a p-value < 0.001 and 564 degrees of freedom (df). For this model, the ratio of $\chi 2$/df, which provides a rough estimate of statistical fit of the model, is 1.76. A $\chi 2$/df ratio lower than 2 is considered good (Bollen, 1989). Second, the comparative fit index (CFI) was estimated. CFI compares a proposed model with the null model, assuming no relationships exist between the measures. A CFI value greater than 0.90 indicates an acceptable fit to the data (Hu and Bentler, 1999). For our measurement model, a CFI value of 0.93 therefore suggests a good fit. Third, we calculated the standardized root mean square residual (SRMR), which is used as an absolute measure of model fit based on the difference between observed and expected correlations. The SRMR of our model is 0.06, which is better than the widely used threshold value of 0.08 (Hu and Bentler, 1999). Last, the root mean square error of approximation (RMSEA) was computed. This index is used to assess the residuals (prediction errors). According to Hu and Bentler (1999), the RMSEA must be ≤ 0.08 for an adequate model fit. The RMSEA value of our model is 0.05, thus indicating an adequate model fit.

4. Results

4.1 Survey Results

Covariance-based structural equation modelling (CB-SEM) utilizing the latest version 28 of Amos (IBM-SPSS®) was employed to test all the hypothesized relationships. CB-SEM is widely used as an analytical approach in organizational and management research. It is a powerful technique for simultaneously examining the relationships between multiple unobserved variables. Compared to other approaches such as partial least squares (PLS) SEM, CB-SEM is deemed a preferred technique (Guide Jr. and Ketokivi, 2015), particularly when its more restrictive data-related assumptions are met, such as large sample size (>200), low model complexity and normal distribution of data (Peng and Lai, 2012). Moreover, as our research model is grounded in well-established theories and seeks to test theory, CB-SEM is considered an appropriate data analysis technique, as per Peng and Lai's (2012) guidelines.

Hypothesis H1 on the antecedent role of institutional pressures on circular procurement is partially supported. Specifically, our results indicate a statistically significant relationship between coercive pressures and circular procurement practices, as hypothesized in H1a (β=0.36 at p=0.01). In comparison, neither mimetic pressures (H1b) nor normative pressures (H1c) show any statistically significant relationship. Hypothesis H2 on the antecedent role of IMS in circular procurement is fully supported (β=0.25 at p=0.00). The direct effect of circular procurement practices on the three dimensions of firm performance, including environmental (β= 0.13 at p=0.07), cost (β= 0.15 at p=0.03) and financial performance (β= 0.32* at p < 0.00), are supported (at p< 0. 1). Surprisingly, the effect of circular procurement on environmental performance is weaker than on economic performance. The survey results are presented in Table 4.

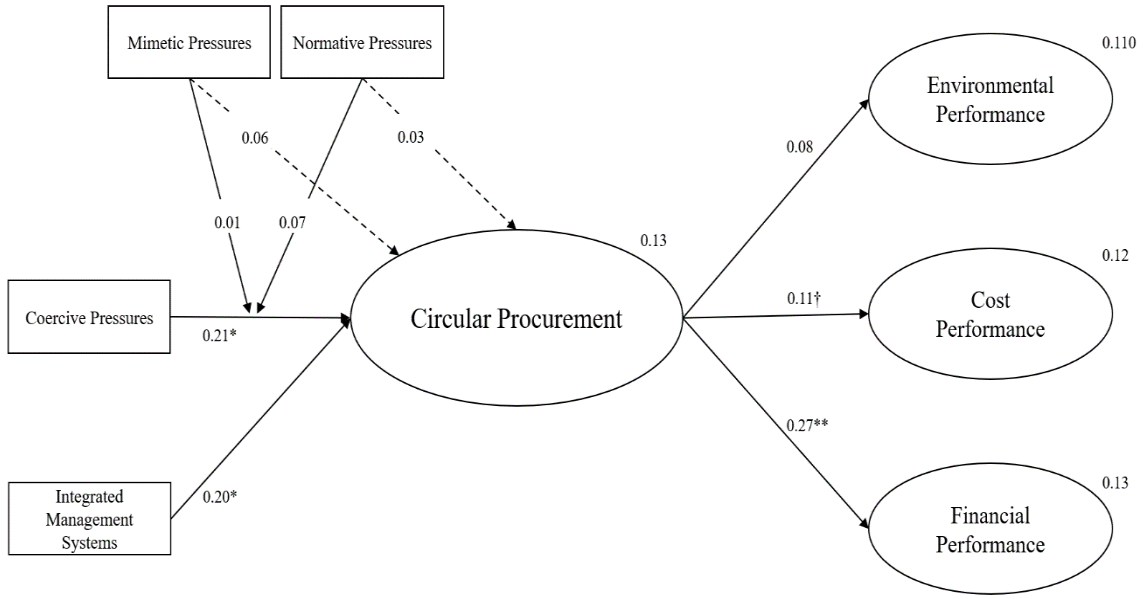
Table 4: Survey Results

	Dependent Variables			
	Environmental Performance	**Cost Performance**	**Financial Performance**	**Circular Procurement Practices**
Control Variables				
Ownership Type Dummy[a]				
Type 1	-0.55	-0.70	-0.15	
Type 2	-0.29	-0.27	-0.04	
Type 3	-0.63	-0.67	-0.10	
Type 4	-0.22	-0.49	-0.05	
Type 5	-0.42	-0.51	-0.08	
Firm Size Dummy[b]				
Size 1	-0.06	-0.03	0.00	
Size 2	-0.02	0.06	0.07	
Size 3	-0.08	0.06	-0.02	
Size 4	-0.14	-0.06	-0.04	
Size 5	-0.09	0.03	0.10	
Industry Dummy[c]				
Industry 1	0.04	-0.06	0.03	
Industry 2	0.10	0.03	0.01	
Industry 3	0.16	-0.11	0.08	
Industry 4	0.02	-0.01	0.02	
Industry 5	0.04	-0.01	0.16*	
Industry 6	0.03	-0.06	0.01	
Industry 7	-0.04	-0.10	-0.04	
Industry 8	0.13	-0.11	-0.01	
Industry 9	-0.05	-0.12	-0.08	
Industry 10	-0.01	-0.03	0.15*	
Industry 11	0.21*	0.00	0.14	
Industry 12	0.12	0.18*	0.20*	
Main Variable(s)				
Coercive Pressure (H1a)				0.36*
Mimetic Pressure (H1b)				0.01
Normative Pressure (H1c)				0.05
IMS (H2)				0.25**
Circular Procurement Practices (H3-H5)	0.13†	0.15*	0.32**	
R^2	0.13	0.16	0.21	0.23

† p < 0.10; * p < 0.05; ** p < 0.01; Structural Model Fit: $\chi 2$: 1928.6 (df =1215); $\chi 2/df$ = 1.59; CFI = 0.91; SRMR = 0.04 and RMSEA= 0.05; baseline dummy variables include: "others" for ownership type[a], "> 8000 employees" for firm size[b], "others" for industry[c]

4.2 Post-hoc analysis

To gain further insights from the data, post hoc analyses were performed. Our survey results do not show statistical support for H1b and H1c as hypothesized in the conceptual model. Although these results seem reasonable due to the dominance of coercive pressures in the Chinese context, we decided further investigation would be worthwhile. In a recent study, Arranz et al. (2022) suggest that mimetic and normative pressures exert their effects in interaction with coercive pressures, but do not have a direct effect by themselves. This finding provided a theoretical base for further analysis aimed at measuring the interaction effects of normative and mimetic pressures with coercive pressures. However, as shown in Figure 2, our data do not support such hypotheses.

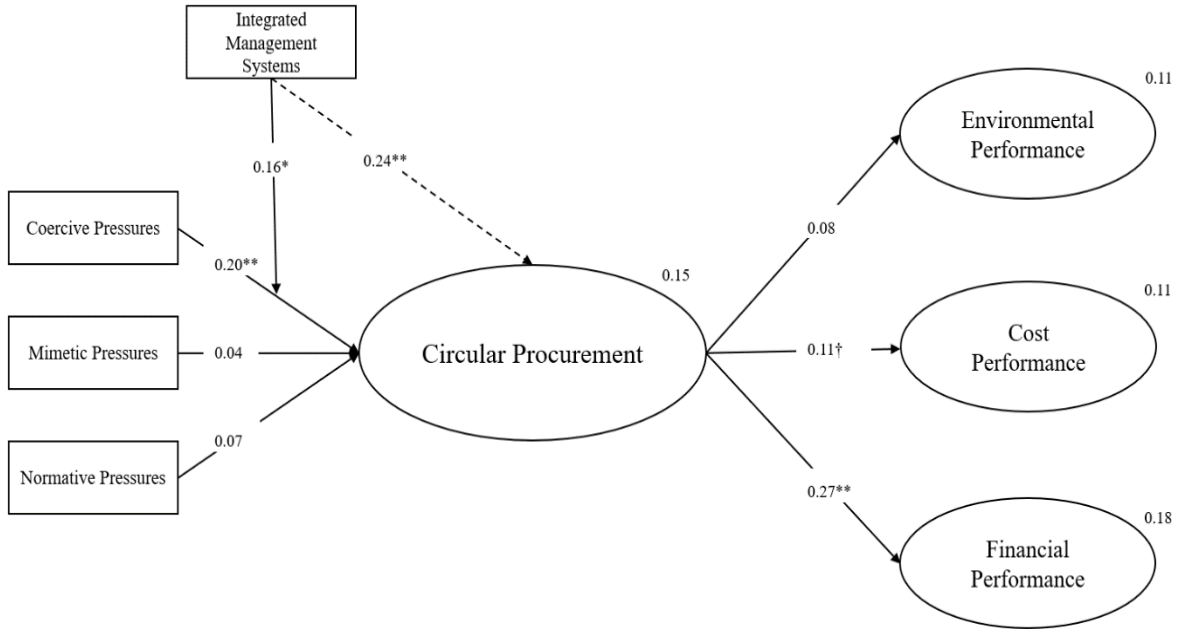


Note(s): Structural Model Fit: $\chi 2$: 127.71 (df =44); $\chi 2/df$ = 2.90.; CFI = 0.96; SRMR = 0.04 and RMSEA= 0.05

Figure 2: *Post hoc* model – Interaction effects of institutional isomorphic factors

Moreover, we also tested the moderating role of IMS on the relationship between coercive pressures and circular procurement practices. Figure 3 confirms a positive and statistically significant interaction effect. Thus, we conclude that IMS plays a dual role as an

antecedent to circular procurement practices while also moderating the coercive pressures-to-circular procurement relationship. Overall, the post hoc analysis validated the results of our original model.



Notes: Structural Model Fit: $\chi 2$: 114.9 (df =41); $\chi 2/df$ = 2.80; CFI = 0.96; SRMR = 0.04 and RMSEA= 0.05

Figure 3: *Post hoc* model – Interaction effects of IMS

4.3 Endogeneity test

The validity of empirical results can be seriously threatened by endogeneity (Lu et al., 2018). In this research, the adoption and implementation of circular procurement practices could be endogenous to better firm performance. We therefore conducted a two-stage least square (2SLS) regression analysis to assess endogeneity following Lu et al.'s (2018) recommendations. For this purpose we used coercive pressure as an instrumental variable because it strongly correlates with the endogenous independent variable, but does directly affect the dependent variable (Rossi, 2014).

In the first stage of the 2SLS test, we found a statistically significant correlation between coercive pressure and circular procurement practices (β=0.30 at $p < 0.01$). Using these stage-1 predicted values, effect on financial performance was examined in the second stage. The results from the second stage did not show any statistical significance ($p > 0.10$). Furthermore, we used the Durbin–Wu–Hausman test procedures to check whether the error terms from stage-1 and the original model correlated with each other (Cameron and Trivedi, 2010). Overall, our test results do not suggest any serious endogeneity problem. Appendix B presents the details of the 2SLS test results.

4.4 Post-survey case studies

Following Li et al. (2020), we conducted two post-survey case studies for better interpretation of the survey results. Although case research is commonly used for theory building in exploratory studies, it can also be used for theory validation (Barratt et al., 2011; Stuart et al., 2002). Two companies, Archroma (Tianjin) Ltd. and Limin Condiment Ltd., were selected based on the purposive sampling method, whereby cases are selected according to the conceptual model and research questions (Miles and Huberman, 1994). Appendix C provides details of the two cases.

Overall, the case study findings fully align with the survey study results concerning the relationships between circular procurement antecedents, practices, and performance. Coercive pressure (the requirements of government and major customers) is the most significant external antecedent, consistent with our survey results. IMS is an internal antecedent of circular procurement activities. It also serves as an assurance and subsequent control for implementation. IMS ensures circular procurement practices are performed in line with international standards and customers' requests and comply with all legal requirements.

For certain circular procurement practices that are mandated by law, the implications for environmental, cost, and financial performance are comparable across companies in the same sector. However, for some other circular procurement practices that are not compulsory, most firms will prioritize considerations of cost and profit when deciding on an appropriate extent of implementation (e.g., in the use or adoption of circular materials). Such a discretionary approach usually leads to improved cost and financial performance. This also explains why the proportion of circular materials usage fluctuates in many companies, as the prices of materials and the final products constantly change.

Circular procurement focuses more on circularity and many of its practices, for example, using circular materials (including packaging materials), do not necessarily require corresponding change in the manufacturing process as such. Consequently, circular procurement practices do not always reduce the emissions and pollutants generated by a firm. As a result, they may or may not have a positive impact on firms' environmental performance depending on the nature of the specific practices being employed. Thus, the resultant positive impact on environmental performance is not always significant. This explains why the effects of circular procurement implementation in China are more significant for financial and cost performance than environmental performance. Overall, the case studies offer valuable insights for understanding the survey results and corroborate the explanatory power of institutional theory and PBV in the circular procurement context.

5. Discussion

5.1 Discussion of the study findings

The main objective of this study was to elaborate on the theoretical foundations of the circular procurement concept and its operationalization in practice, as well as providing a clear picture of the antecedents of circular procurement practice and the firm performance outcomes.

Building on institutional theory and the PBV, we hypothesized institutional pressures and IMS as the antecedents of circular procurement practices, which positively affect the firm's environmental, cost, and financial performance. The hypotheses were examined using a survey of 255 Chinese manufacturers and two post-survey case studies. Our study results demonstrate that coercive pressures and IMS are important antecedents to circular procurement practices among Chinese manufacturers. Moreover, we find circular procurement practices to have a statistically significant relationship across the three performance dimensions. However, this relationship is the weakest when it comes to the environmental performance dimension.

Among institutional pressures, the positive relationship between coercive pressures and the adoption of circular procurement practices among Chinese manufacturing firms is consistent with findings from previous studies focused on traditional procurement concepts for sustainability (Zhu et al., 2013b; Zhu et al., 2018). For Chinese manufacturers, we find three major sources of coercive pressure for adopting CE. First, due to the Chinese government's stringent laws and regulations dictating a transition towards a CE, Chinese manufacturing firms have adopted a number of operations and supply chain CE practices, including circular procurement (Farooque et al., 2019). Second, the transition to a CE has become a worldwide phenomenon, with major economies such as the United States of America, the United Kingdom, and many EU countries starting to recognize its importance. Similarly, major global corporations have committed to enhancing circularity in their supply chains (Gartner, 2019). In this regard, the manufacture of exports to major customers in these countries and sales to locally operated foreign firms in China require Chinese manufacturers to adopt more circular ways of doing business. Industry leaders, represented by major corporations, are indeed powerful stakeholders in the transition to the CE as a result. In turn, their commitment to the CE has a cascading effect in their supplier networks (Wang et al., 2022). Thirdly, most Chinese firms face intense competitive conditions, both locally and internationally. This implies that

manufacturing firms must find innovative ways to gain a competitive advantage over their rivals. The implementation of CE practices could help Chinese firms gain a competitive advantage by enabling them to reap economic benefits while simultaneously reducing negative environmental impacts (Geng et al., 2019).

We did not find any statistically significant impact of mimetic and normative pressures on the adoption of circular procurement. This may reflect the dominance of coercive pressures in the Chinese manufacturing context, despite the presence of mimetic and normative pressures. These findings seem plausible because the adoption of circular procurement practices among Chinese manufacturers has still not reached high levels. It could be that firms are cautious in imitating the actions of their competitors, especially in the absence of clear competitive benchmarking (Kauppi, 2013; Sancha et al., 2015; Zhu et al., 2013b). Similarly, due to lack of established industry standards for circular procurement, the influence of normative pressures is likely to remain weak (Tate et al., 2011; Zhu and Sarkis, 2007).

The role of IMS as an antecedent of circular procurement practices is well supported by our empirical results. While the importance of integrating multiple management systems in organizations is well established in the extant literature, IMS remains unexplored as an antecedent of CE-oriented procurement practices, i.e., circular procurement. Therefore, our study results highlight the distinctive benefits of IMS implementation beyond the usual performance benefits, which are reported in abundance (Porter, 1996; Villena et al., 2021).

Our results show that circular procurement practices are positively associated with better firm performance, including environmental and economic (i.e., cost and financial) performance. This finding contributes to the ongoing debate and helps clarify inconsistent findings regarding the economic performance benefits associated with sustainability-oriented procurement practices. For example, Khan et al. (2022), Arora et al. (2020) and Song et al.

(2017) find sustainable and green purchasing practices to be positively associated with the economic sustainability of firms, while Brewer and Arnette (2017) report that environmental performance is not related to economic performance. In this regard, our findings constitute a significant and timely contribution by providing empirical evidence in support of a simultaneous improvement in firm environmental and economic performance associated with circular procurement practices. However, it is important to note that the impact of circular procurement practices on environmental performance is relatively weak in comparison to economic performance.

5.2 Theoretical contributions

The theoretical contributions of our study are threefold. First, this pioneering work sheds light on the theoretical foundations of the circular procurement concept as a "business not as usual" approach to firm and supply chain level purchasing decisions (Knight et al., 2022). We present circular procurement as distinct from existing procurement concepts in the extant literature, such as green, environmental, socially responsible and sustainable procurement. The circular procurement practices construct used in this study applies to both the public and private sectors (Qazi and Appolloni, 2022; Xu et al., 2022).

Second, we further extend the use of institutional theory in operations and SCM research by empirically testing the antecedent role of institutional isomorphic factors in relation to the adoption of CE and circular procurement in the Chinese manufacturing industry context (Kauppi, 2013). Based on our study results, normative and mimetic pressures do not currently seem to play a significant role in driving circular procurement practices in the Chinese manufacturing industry. This interesting finding suggests that coercive pressures have the most effect on firms, especially in the early stages of implementing CE-oriented firm and supply chain level practices. Finally, we link with the PBV of strategy to explain how the existing routines in organizations (such as IMS) support the development of new practices (such as

circular procurement practices). Moreover, our study results also strengthen the practice-to-firm performance premise of the PBV in the operations and SCM research domain, where practices are often imitable, available in the public domain, and transferable across firms (Bromiley and Rau, 2014, 2016).

5.3 Policy implications

Given the significant role of coercive pressure in driving the CE and circular procurement practices in China, Chinese policymakers could enact more targeted legislation to promote circular procurement. Environmental legislation is a very effective source of coercive pressure that Chinese manufacturers respond to. Targeted legislation is not uncommon in China. For example, the cleaner production promotion law, issued in 2002, required certain enterprises to implement cleaner production practices (Hicks and Dietmar, 2007). Circular procurement promotion laws could be enacted along similar lines to enforce the implementation of circular procurement practices in carefully selected public and private sector organizations. As a first step, we suggest implementing circular procurement practices in the public sector as it represents a significant chunk of government spending. We also call for the active involvement of professional networks, industry associations, and academic institutions in promoting firm and supply chain level CE practices such as circular procurement. Although our research does not show a direct relationship between normative pressure and circular procurement adoption, these institutions can at least serve as important sources of information and knowledge about circular procurement practices.

5.4 Practical implications

The results of this study offer multiple important insights for practitioners. First, we suggest that Chinese manufacturers take a more proactive stance toward investing in circular procurement initiatives, given the long-term economic as well as environmental benefits. Firms should consider secondary materials that are recovered by a variety of methods, for example,

repairing, refurbishing, remanufacturing, and recycling etc. The recovered secondary materials can become new source(s) of materials for manufacturing purposes, creating substantial economic benefits for the buying firms. Furthermore, such a BNAU approach to purchasing decisions improves firms' resilience to supply chain disruptions (George et al., 2016; Knight et al., 2022).

Second, powerful corporations (i.e., focal firms) should use their positional power to exert coercive pressure to drive the transition to CE in their extended supply chain (which includes customers, suppliers and sub-suppliers). As revealed in our study results, coercive pressure is the most effective institutional pressure for driving circularity within supply chains. However, there is a dearth of industry leaders or champions in the Chinese manufacturing sector for other firms to benchmark against when adopting CE practices (Kauppi, 2013; Sancha et al., 2015). This may be taken as an opportunity by influential focal firms to become industry leaders known for circularity in their supply chains, especially on the procurement side of operations.

Third, practitioners need to understand 'how to improve circularity', which is not necessarily the same as becoming greener or more sustainable. Circularity in purchasing, i.e., circular procurement, requires a deeper understanding of the physical attributes of what is being procured, and must explicitly reflect circular thinking. These physical attributes include naturally sourced, renewable, restorable or biodegradable, secondary, non-hazardous, and energy-efficient materials that contribute to closing the energy and materials loops and minimizing and/or eliminating environmental impacts and waste (European Commission, 2017; Farooque et al., 2022).

Lastly, the adoption of CE principles and practices, including circular procurement, inevitably contributes to the attainment of the UN's Sustainable Development Goals

(Schroeder et al., 2019; Van Wassenhove, 2019) and therefore must be taken seriously. Additionally, such efforts by firms must be publicized and celebrated, which in turn not only contributes to their reputation but also becomes a source of inspiration and example for other firms to follow.

6. Conclusions

The consumption of natural resources has far exceeded planet earth's regenerative capacity, posing a grand challenge. There is a growing consensus that the CE offers a systems solution framework to redress the depletion of natural resources. Circular procurement has gained popularity in the CE context; however, its theoretical foundations and operationalization in practice remain unclear. This research set out to fill this research gap by identifying antecedents as well as performance outcomes of circular procurement practices in terms of the environmental and economic (i.e., cost and financial) dimensions. Our survey results provide empirical evidence that coercive pressures and IMS are antecedents of circular procurement practices at the firm level. In particular, the antecedent role of IMS has not been well recognized in the extant literature because most studies focus on the direct, and enabling or moderating role of IMS on firm performance. Furthermore, our empirical results confirm that circular procurement practices are positively associated with environmental, cost and financial performance. Intuitively, many would expect circular procurement to have a strong positive effect on environmental performance. However, our finding suggests only a weak positive effect, which is non-intuitive, with insights from the case studies offering reasonable explanations for this unexpected finding. Based on the study results, we have derived important and timely implications for theory, practice and policy.

Despite its significant contributions, similar to other empirical studies, this study has its limitations. Firstly, our study relied on the social variant of institutional theory to identify

drivers of circular procurement. However, in recent years, the economic variant of institutional theory has received considerable attention. Future research could therefore consider the economic variant to explore more relevant drivers. Similarly, with regard to enablers, this research provides a view restricted to the PBV of strategy. Other theoretical perspectives, for example, the resources-based view and related theories could be considered in the future to identify other critical enablers. Secondly, within our multi-method approach, we conducted a questionnaire survey using convenience sampling, which may introduce bias and undermine generalizability. Moreover, only two primary data-based case studies were conducted for explanatory purposes in addition to the cross-sectional survey data. It would be worthwhile for future researchers to consider using random sampling methods alongside a longitudinal research design to overcome these limitations and gain additional insights. Thirdly, despite our efforts to collect matched response survey data, most responses were collected from only one respondent in a participating firm. Moreover, we used perceptual measures for all variables, including firm performance. Although our rigorous statistical testing for CMB does not provide any evidence of biases, we strongly recommend that future research use multiple data sources, including matched response surveys and objective secondary data, which is ideal for performance variables. Lastly, the context of this study is China. Based on the findings of this study, future research could be conducted to examine other economies and countries to improve and verify the generalizability of this study's findings.

Acknowledgements

Dr Abraham Zhang acknowledges partial funding support from the 2020 Endeavour Fund, Ministry of Business, Innovation & Employment of New Zealand (Project title: Āmiomio Aotearoa - A Circular Economy for the Wellbeing of New Zealand). Dr Yanping Liu acknowledges the funding support from the National Social Science Fund of China (Grant No. 19BGL090) and Asia Research Center in Nankai University.

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Appendix A: Survey questionnaire

Study variables and their measurement items		
Coercive Pressures		Scale anchors: 1= Strongly disagree – 5= Strongly agree
COER1	"The local government requires our firm to implement CE practices"	
COER2	"Our major customers require our firm to implement CE practices"	
COER3	"The competitive conditions require our firm to implement CE practices"	
Mimetic Pressures		Scale anchors: 1= Strongly disagree – 5= Strongly agree
MIMT1	"Our main competitors who have adopted CE practices have greatly benefitted"	
MIMT2	"Our main competitors who have adopted CE practices are favorably perceived by others in the same industry"	
MIMT3	"Our main competitors who have adopted CE practices are favorably perceived by their suppliers and customers"	
Normative Pressures		Scale anchors: 1= None – 5= High
NORM1	"Indicate the extent of CE practices adoption by your firm's main suppliers"	
NORM2	"Indicate the extent of CE practices adoption by your firm's main customers"	
NORM3	"Indicate the extent to which the Government's promotion of CE influences your firm to implement CE practices"	
NORM4	"Indicate the extent to which the industry's and professional associations' promotion of CE influences your firm to implement CE practices"	
Integrated Management Systems		Scale anchors: 1= Not at all – 5= To full extent
IMS1	ISO 14000 serial certification	
IMS2	ISO 9000 serial certification	
IMS3	Total quality management type programs	
IMS4	Lean/Just-in-time systems	
Circular Procurement Practices		Scale anchors: 1= Not at all – 5= To full extent
CPR1	"Require your main suppliers to use materials that are used (non-virgin), repaired, refurbished, remanufactured or recycled"	
CPR2	"Require your main suppliers to use environmentally friendly packaging (e.g., non-hazardous and recycled etc.)"	
CPR3	"Prefer renewable energy sources when selecting energy providers"	
CPR4	"Consider water and energy savings in product use when purchasing products"	
CPR5	"Consider the amount of waste production in product use when purchasing products"	
CPR6	"Consider the impact of transportation emissions when selecting suppliers"	
Cost Performance		Scale anchors: 1= Substantially lower – 7= Substantially higher
CP1	"Cost of purchased materials"	
CP2	"Operational cost"	
CP3	"Energy consumption cost"	
CP4	"Waste treatment fee"	
CP5	"Waste discharge/disposal fee"	
Financial Performance (FP)		Scale anchors: 1= Substantially lower – 7= Substantially higher
FP1	Growth in sales revenue	
FP2	Return on sales	
FP3	Growth in profit	
FP4	Net Profit Margin	
FP5	Return on investment (ROI)	
FP6	Growth in market share	
Environmental Performance (EP)		Scale anchors: 1= Substantially lower – 7= Substantially higher
EP1	Emission of greenhouse gases (e.g., CO2, SOx, NOx...)	
EP2	Waste water (e.g., sewage)	
EP3	Other wastes (e.g., oily waste, sludge and rubbish)	
EP4	Total amount of hazardous and toxic waste	
EP5	Consumption of hazardous/harmful/toxic materials	

Appendix B: 2SLS regression model for endogeneity test

Variables	**(1) Circular Procurement Practices**	**(2) Environmental Performance**	**(3) Cost Performance**	**(4) Financial Performance**
Controls				
Ownership Type				
Type 1	-0.17	-0.47	-0.65	-0.21
Type 2	-0.07	-0.25	-0.28	-0.06
Type 3	-0.02	-0.57	-0.77	-0.15
Type 4	-0.13	-0.18	-0.48	-0.08
Type 5	-0.07	-0.37	-0.59	-0.13
Firm Size				
Size 1	-0.02	-0.05	-0.01	-0.03
Size 2	-0.25	0.06	0.06	0.03
Size 3	-0.14*	-0.03	0.07	-0.03
Size 4	0.02	-0.16	-0.06	-0.02
Size 5	0.00	-0.07	0.02	0.08
Industry				
Industry 1	0.05	0.03	-0.02	0.02
Industry 2	-0.11	0.11	0.05	0.00
Industry 3	-0.19*	0.22*	0.01	0.09
Industry 4	-0.05	0.03	0.01	0.01*
Industry 5	-0.03	0.02	-0.01	0.16
Industry 6	-0.02	0.02	-0.05	0.01*
Industry 7	-0.04	-0.04	-0.07	-0.03
Industry 8	-0.05	0.13	-0.05	0.01*
Industry 9	-0.13*	0.00	-0.09	-0.07
Industry 10	-0.08	0.03	-0.01	0.13
Industry 11	-0.20*	0.27*	0.04	0.12
Industry 12	0.02	0.13	0.20*	0.19
Main variable				
Circular Procurement Practices	--	0.22	0.10	0.11
Coercive Pressures	0.34**	--	--	--
R^2	0.22	0.12	0.11	0.12

Appendix C: Case study details

Case study 1: Archroma

Archroma is a leading provider of specialty chemicals to a diverse range of markets, including branded and performance textiles, adhesives, coatings, packaging and paper, and sealants, around the globe.[1] It is headquartered in Switzerland and does business in over 100 countries. It operates 25 production sites with a total workforce of 2800 employees across 31 countries. In 2021, Archroma joined the 'Science Based Targets' initiative in line with its net-zero ambition. Moreover, it continues to fulfill its responsibilities as per the UN Global Compact.[2] Archroma received an EcoVadis platinum rating in CSR (among the top 1% of best-rated companies in the industry) in 2021.

The Chinese subsidiary of Archroma (Tianjin) Ltd. operates global ISO-standardized management systems, including ISO 9001, ISO 14001, ISO 45001, and ISO 50001. The company is highly regarded as an established leader in sustainable chemistry in China as it continuously strives to innovate in its transition to CE and circular procurement. Archroma made the Top 50 companies in the Green Supply Chain Corporate Information Transparency Index (CITI) evaluation report of the Institute of Public & Environmental Affairs (China) and was awarded the provincial honor of "Green Factory" in 2020.

We interviewed eight managers at Archroma (Tianjin), including two senior executives and six managers from the production, environment, quality, and purchasing departments. In line with our theorization, the interviewees were vocal about the need of implementing circular procurement in response to the company's commitments to CSR and the pressures from local

[1] For details, please visit: https://www.archroma.com/.
[2] Details available at: https://www.unglobalcompact.org/what-is-gc/mission/principles.

government, customers and market competition. “Archroma is not only a leader in the industry market but also a leader in circularity and sustainability – which is the company’s commitment and the requirement of CSR," said the general manager of Archroma (Tianjin). All interviewees indicated that ISO management systems have positive effects on implementing circular procurement.

Archroma recognizes the importance of fostering a CE, i.e., evolving from linear (take, make, discard) to circular (reduce, reuse, recycle) manufacturing. Archroma manages procurement within the three pillars of cost, quality, supply security and sustainability. The environmental impacts of procurement, in terms of direct impact on its manufacturing and indirect impact on its customers, is a key area within Archroma’s procurement quality management. To assess suppliers' sustainability performance, Archroma has implemented a sustainable sourcing program, and new suppliers are required to either provide existing sustainability performance results (Together for Sustainability (TFs) audit or EcoValids assessment, or other report & certification), or undergo a sustainability assessment by the Archroma’s procurement team.

The circular procurement practices at Archroma include the following:

(1) *Procuring secondary or renewable materials to reduce the consumption of non-renewable materials*. Archroma has been using recycled and reconditioned packaging material, such as intermediate bulk containers, for part of its product portfolio.

(2) *Substituting inputs having hazardous characteristics with inputs that are non-hazardous*. Archroma replaced chlorinated organic raw materials with agricultural waste to produce EarthColors®.

(3) *Reverse logistics and product take-back initiatives to divert used packaging*

materials from being sent to landfills. Archroma works with well-known packaging material suppliers and engages in the countrywide recollection network.

These innovations in circular procurement lead to better cost, environmental and financial performance and increase product value throughout the supply chain. During our interview with the general manager, he mentioned that the company has greatly benefited from its efforts in successfully managing environmental, social, and governance (ESG) issues, including circular procurement. "Collaborating with leading brands such as Patagonia, G-Star, Esprit, Primark, and others, Archroma has shifted 42% of sales to sustainable innovations and solutions over the past three years and become a prominent name for more sustainable colors and performance ingredients," reported the general manager.

Case study 2: Limin

Limin Condiment Co., Ltd. (or simply 'Limin' hereafter) is a well-known brewing and compound condiment producer in China. Its main product categories include garlic chilli sauce, sweet fermented flour sauce, tomato paste, soy sauce, sugar, and monosodium glutamate.[3] Limin ranks among the top 20 in the Chinese condiment industry and the second largest in sauce products (Limin Condiment, 2023). As a state-owned company founded in 1956, Limin has 753 employees and sales revenue of over 1.1 billion RMB (2021).

Limin has served as one of the model organizations for China's industry standards on sweet, fermented flour sauce and the national standard for chilli sauce. Limin has set up strict quality and management systems such as ISO 9001, ISO 14001, ISO 22000, HACCP, OHSAS18001, and GB/T 33300. Limin is paying increasing attention to the CE and has established a sustainability management system. Based on its continuous efforts and

[3] For details, please visit: http://www.liminhot.com/webEn/m/jianjie.html.

achievements in implementing green manufacturing, green procurement, and green SCM, Limin was awarded the national honors of "Green Factory" and "Green SCM" in 2020.

We conducted eight interviews at Limin, involving seven department heads and one deputy general manager in the R&D, production, environment, quality, marketing, purchasing, and logistics departments. All interviewees agreed on the presence of internal and external pressures for implementing the CE and circular procurement. Requirements from the government and the market were identified as the two most important pressures positively affecting the implementation of circular procurement at Limin. Consistent with our survey results, all interviewees indicated that their management systems including ISO standards have positive and significant effects on their circular procurement implementation, i.e., IMS enables the successful implementation of circular procurement. The deputy general manager said, "It is not only the commitment to CSR but also the responsibility of a state-owned company to implement CE practices, including green manufacturing, circular procurement, and green SCM."

Some of the key circular procurement practices at Limin include the following:

(1) *Establishing subsidiaries in primary raw material-producing areas.* To ensure supply stability and the quality of raw materials, Limin invested in primary raw material-producing areas and established two fully-owned subsidiaries. "Limin has established a product traceability system, and all information can be tracked, including logistics, production process, suppliers, and the raw material producing areas," said the head of the quality department during the interview.

(2) *Production of clean energy.* Limin has invested in the photovoltaic power generation project and uses it as a supplementary energy source, "which accounted to around 40% of the total power consumption and led to about 5% reduction in energy expenditure in

2021," according to the head of the energy department.

(3) *Increasing the use of packing materials that are easier to recycle or remanufacture.* Considering the quality and safety requirements for food production, no hazardous or harmful materials, including packaging materials, can be used. Limin mainly uses three packaging types, glass bottles, plastic buckets, and plastic bags, among which the materials for the first two are easy to recycle or remanufacture. Thus, "Limin increased the proportion of packing types of the glass bottle and plastic bucket, and the recycling rate of end-of-life product packages amounted to 50% in 2021", said the head of the R&D department.

All interview participants agreed that these practices contribute to overall cost reduction and improved financial performance. However, given the specific nature of the food items they produce, the primary materials/ingredients cannot be recycled. Therefore, circular procurement practices mainly focus on packaging materials and energy source selection. As a result, the impact on environmental performance is not markedly high.