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Role of Traditional Chinese Philosophies and New Product Development under Circular Economy in Private Manufacturing Enterprise Performance

Abstract

The New product development (NPD) process-performance link has been sufficiently studied in academic research. However, the more recent NPD trend is significantly different from the conventional NPD with the inclusion of sustainability considerations, which is evidenced by the growing body of research on sustainable NPD and green NPD. In the context of Circular Economy (CE), it is no longer viable for companies to stick to conventional NPD process which targets only at profit. Instead, their NPD process must have some CE elements either due to self-interest or stakeholder requirements. In theory, NPD with CE considerations (hereafter CE-NPD), compared with conventional NPD, is associated with higher costs and longer development times due to the fulfilment of CE requirements along with product functions. This study empirically examines the effect of CE-NPD process on both Time-to-market (TTM) and profit performance in the context of Chinese private enterprises. In addition, the role of traditional Chinese philosophies of Confucianism and Taoism in influencing the CE-NPD process-performance link is also investigated. We find that firms' CE-NPD projects reduce TTM and increase profit. Moreover, Confucianism positively moderates the relationship between CE-NPD process and TTM performance. However, it negatively moderates the CE-NPD - profit link. On the other hand, the moderating effect of Taoism is negative on both the CE-NPD - TTM and CE-NPD - profit links. An interesting finding of this study is that the coexistence of Confucian and Taoist values in NPD workers has the strongest positive impact on the relationship between CE-NPD process and performance. Our study

provides insights on the way in which companies should plan to apply Chinese philosophies during the CE-NPD process to maximize the benefits.

Keywords: *Circular economy, new product development, Confucianism, Taoism, private enterprises*

1. Introduction

The new product development (NPD) process, from idea generation to the introduction of the new product to market, has significant impact on business performance (Praxnikar and Skerlj 2006). This is particularly the case in industries such as the pharmaceutical and electronics. According to Praxnikar and Skerlj (2006), there are several benefits generic companies can enjoy if they successfully bring new products to the market earlier than rivals, including high market share, barriers to entry for late movers, as well as well-established brand awareness among consumers. A more obvious example is Apple, who has been seeing increasing profits from its continuous upgrading of products in a short span of time, achieving significant market penetration and expansion. In today's highly volatile business environment, companies are less likely to survive the fierce competition by always offering the same product, no matter how good the quality is (Kettunen et al. 2015). Therefore, the development and introduction of innovative new products to the market plays a key role in corporate growth by helping companies maintain the existing market and explore new markets, which ultimately enhances the competitive advantage (Mu et al. 2015; Friedman 1996).

The positive effect of NPD process on performance has been well proven by all sorts of evidence, anecdotal and/or academic. However, the recent NPD trend including sustainable NPD and green NPD is significantly different from the conventional NPD (Gmelin and Seuring 2014a). This is primarily driven by emerging challenges such as environmental degradation and resource depletion, as well as the increasing environmental awareness of consumers. Today, environmental protection initiatives

are encouraged at both national and corporate levels all over the world and Circular Economy (CE) is increasingly considered when countries especially emerging markets and developing countries develop new policies and business models (Zhu et al. 2010). To respond to national CE requirements, companies are making efforts ranging from environmental/sustainable operations/supply chain management to sustainable marketing activities (Zhu et al. 2010; Zeng et al. 2017), of which NPD with CE considerations (CE-NPD) is one of the most prominent areas. A typical example of CE-NPD can be seen in Puma, a leading sportswear giant in the world, where the InCycle Collection was developed. The products are either recyclable or biodegradable, and consumers are encouraged to return the end-of-life products to Puma under the company's "Bring Me Back" program.

The effectiveness of NPD process has been proven to be influenced by cultural factors (Parente et al. 2011). Within NPD process and performance, concept and product development depends on human creativity, which is largely driven by cultural and behavioral aspects of the context. According to Liang et al. (2014), Chinese managers differ from their American counterparts in making NPD decisions. As holistic thinkers, Chinese managers were found to be more likely to escalate their commitment compared with Americans (who are referred to as analytic thinkers) upon receiving a negative performance report during the NPD process (Liang et al. 2014). In the context of CE-NPD, because consumer demand for sustainable products is difficult to predict, negative feedback on new products should be expected to happen. In this case, how managers react and proceed is crucial to the success of the CE-NPD efforts. In addition, the concept of CE-NPD itself could be discouraged by the Chinese "one-time consumption" culture as Chinese consumers prefer brand-new products (Xiang and Ming 2011). Thus, companies operating in different cultural backgrounds are expected to experience different levels of NPD performance based on how efficiently and effectively they can transform their ideas into acceptable products (Polychronakis and Syntetos 2007).

A previous study suggested that firms are relatively successful in implementing quality practices by creating a quality culture instead of simply implementing practices such as total quality management and statistical quality control tools (Srinivasan and Kurey 2014). As per the study, a true culture of efficiency and reuse mentality is an environment where people feel efficiency and conservation around them. It is not implementing best practice or training, but should be driven at a grassroots level through cultural and behavioral attributes such as leadership emphasis, message credibility, resource utilization, value of the product, peer involvement, and employee empowerment (Srinivasan and Kurey 2014). Different contexts have their own cultural values and beliefs, in the case of China, two well-known eminent philosophies for learning and knowledge development and behavioral attitude are Confucianism and Taoism. These two philosophies are commonly regarded as the two major sides of the Chinese culture, and believed to have simultaneous influence on Chinese people, at varying levels for different people though (Lin et al. 2013).

This study is situated in the context of Chinese private enterprises. Nowadays, a few privately owned Chinese firms such as Xiaomi, Alibaba, and Lenovo have made big impacts through frugal innovations that produced competing products at low cost in a short span of time. On the one hand, a key advantage of private enterprises especially Small and Medium Sized Enterprises (SMEs) is their adaptability to market changes (Cooke 2008). As an emerging business opportunity, whether the CE considerations are grasped by private enterprises has not been studied so far. On the other hand, private enterprises are believed to be different from their state-owned counterparts in terms of the access to resources (Cheng and Lei 2015). With limited resources available, private enterprises are facing serious challenges in terms of product innovations especially CE-NPD due to the costs and risks involved. Hence, private enterprises are expected to behave differently from state-owned companies in terms of CE-NPD adoption.

The major purpose of this study is to empirically test the effect of the new trend of NPD, CE-NPD, on performance among Chinese private enterprises. In addition, we also investigate the role of philosophical factors in influencing the CE-NPD process - performance link. As important philosophies originating from ancient China, the role of Confucianism and Taoism in interacting with firm CE-NPD activities to achieve superior performance has not been sufficiently researched. This study is organized as follows. The next section briefly reviews the present literature on NPD and CE, and Chinese traditional philosophies of Confucianism and Taoism. This part is followed by hypotheses and framework development. Then the paper presents research methodology, data analysis, and discussions on the results. We conclude the paper with contributions, implications and limitations.

2. Literature Review

2.1 NPD Process and performance

NPD has been conceptualized as “communication networks, problem-solving or decision-making chains” which contain a series of stages (Gonzalez-Zapatero et al. 2015). Researchers have developed different models of NPD. For instance, Cooper (1984) proposed the stage-gate model for NPD. The five stages are scoping, building a business case, development, testing and validation, and launching from the NPD process. According to Urban and Hauser (1993), NPD is a four-stage model consisting of business/market analysis, technical development, product testing, and product commercialization. More recently, Genc and Di Benedetto (2015) simplify the NPD process as consisting of concept development, product development, and product commercialization. In response to increased market competition, the NPD process has been evolving from a staged model to a concurrent concept, which means that design and development are scheduled in parallel with a purpose of increasing efficiency and saving costs (Maylor 1997). In essence, NPD as an interdisciplinary process includes activities such as idea generation, product development, and the introduction of new products to the market, which requires the cooperation between different functions of

the organization. In this study, although we do not rely on a specific NPD model, we implicitly take a concurrent perspective. We focus on idea generation and final product design activities because they largely rely on people's behavior, attitudes, and cultural values, which are predominant over the technical product development aspects. More importantly, CE considerations are crucial at these two stages as the ultimate success of the new product depends on good ideas and high consumer acceptance.

The success of NPD is usually evaluated with two indicators, namely, profit and development time (Parker and Brey 2015). Profit, as a direct measure of organizational performance, reflects the revenue from consumer purchasing. Successful new products provide companies with opportunities to explore new markets and better satisfy the emerging needs of their current markets, which is usually evidenced by high sales and profit. Research shows that new products constitute about 25% or one-third of enterprises' financial benefits (Nayak 1993). Another important measure of NPD performance is Time-to-market (TTM). TTM is defined as the period from the design of the new products to marketing, which is more important for certain industries where the product life cycle is extremely short (Afonso et al. 2008). It is important for companies to shorten product development time and introduce products to the market earlier than their rivals to obtain first mover advantage and secure competitive advantage (Parker and Brey 2015; Li 2013). On the other hand, when the TTM of an enterprise is lower than the industry average level, it can take a higher skimming-price strategy to obtain market share and recover investment sooner, thereby reducing the risks associated with the NPD process and contribute to profit ultimately.

The NPD process and its impact on business performance have been well studied (Genç and Di Benedetto 2015). According to Barney (1991), a firm can maintain a competitive advantage if it possesses simultaneously valuable, rare, inimitable, and

non-substitutable (VRIN) resources. Knowledge, as a typical type of such resources, is key to competitive advantage (Grant 1996). As suggested by Grant (1997), competitive advantages are more likely to be built and sustained if organization knowledge can be integrated in a way that is difficult for outsiders to replicate but easy for internal dissemination. In the context of NPD, ideation and product design are knowledge-intensive people-related activities. Firms with more knowledge and stronger learning capabilities are more effective in developing new products others, as successful ideation and design require organizations and their members to constantly enhance their knowledge base and adaptability to market changes (Frankort 2016; Lee, Woo, and Joshi 2016). The difference in NPD outcomes can be explained by resource (knowledge) heterogeneity.

2.2 CE and CE-NPD process

The concept of CE is becoming increasingly popular since the 1970s (Geissdoerfer et al. 2017). It is defined as “a regenerative system in which resource input and waste, emission, and energy leakage are minimized by slowing, closing, and narrowing material and energy loops” (Geissdoerfer et al. 2017, p. 759). As indicated in the definition, a CE is a win-win situation, where ecological benefits and economic development are achieved simultaneously (Zeng et al. 2017). It is a development model covering different levels of the society, ranging from individual corporates to the region and the country (Su et al. 2013).

Research on CE is growing rapidly in recent years. A recent study by Diallo et al. (2016) reviewed the usage of quality, reliability and maintenance issues in closed loop supply chains with remanufacturing. The prominent findings of their study are ignorance of degradation of product life during design, ignorance of customer perspective and usage of the product during design and consideration of safety during remanufacturing of products. Similarly, different value recovery strategies for electronic components in a closed loop supply chain have been analyzed by Lehr et al. (2013). In terms of quality of reuse of products Meng et al. (2017) proposed a model

which considers remaining useful life based on condition monitoring and failure data to develop recovery strategies for managers' intent to reuse components.

As the biggest emerging market, China has been making active efforts to transform to a CE society, which is evidenced in its recent five-year plans. Under a national CE development model, at the corporate level, CE considerations are becoming an inevitable part of NPD process, production, as well as purchasing and consumption (Nature, 2016). As a result, while companies are making efforts to fulfill and exceed consumer requirements with their products, they must also take the reduction, recycling and reuse (3Rs) of the end of life products into accounts when at the very beginning of product development. Thus, the new trend of NPD can be distinguished from conventional NPD based on CE considerations, which add more complexities to the NPD process (Gmelin and Seuring 2014a). In the current world where environmental protection and sustainability is a key topic, it makes less sense to study NPD process without any CE/green/sustainability considerations as all the countries in the world are emphasizing sustainable development, in different forms and at varying degrees though.

In this study, the way we understand CE-NPD is consistent with Genç and Di Benedetto (2015). CE-NPD is not completely different from conventional NPD, and the key difference is the addition of CE considerations during the process. However, due to the increased complexity associated with CE-NPD, the effect, or at least the direct effect, of CE-NPD process on performance becomes less clear as costs of developing new products are inevitably increased with the inclusion of extra factors, and the CE-NPD development period should be expected to be lengthened.

2.3. Confucianism and Taoism and their key teachings

As two of the most influential philosophies in China, Confucianism and Taoism basically govern people's behavior in every aspect of life. As these are broad philosophical systems, it is impossible to examine the effects of all the teachings of each philosophy on the CE-NPD – performance link. As a result, we focus on the

most relevant attributes of Confucianism and Taoism, and investigate the ways in which they could facilitate or hinder the realization of desired outcomes of CE-NPD activities.

Confucianism and Taoism coexist in the Chinese philosophical system. According to Ye (2014), both philosophies started to integrate and jointly influence the Chinese people during Song and Ming Dynasties. Key teachings of both philosophies are discussed below.

2.3.1 Confucianism

Confucianism dominates the Eastern culture (Suen, Cheung, and Mondejar 2007). It is a comprehensive philosophical system covering moral, social, political, philosophical, and quasi-religious thought (Ye 2014). Confucianism advocates five virtues, which are Jen (benevolence), Yi (righteousness), Li (propriety), Chi (wisdom) and Hsin (honesty and trustworthiness), of which Jen and Li are more relevant to the context of CE-NPD (Ye 2014). While Jen means to love the people around you, Li holds that everyone should conduct in a reasonable manner that suits for one's situation or status. Based on Jen and Li, Confucianism emphasizes the importance of society, the group, discipline, continuous learning, and hierarchical relationships within a society (Lee, Lee, and Souder 2000). To always pursue what is known as "the good-of-the-group" or He Xie (harmony), Confucianism creates a "collectivist" culture (Romar 2002). It holds that individuals are the key ingredient of symbiotic relationships rather than isolated persons (Yeung and Tung 1996; Lin et al 2013). Unlike the West, where the essential effect on individual behavior is of paramount importance, the Chinese context values mutual interest. To a large extent, this common interest triggers the appearance of Guanxi, which means building connections between two independent parties to allow them to favor each other and share information related to product development. The bilateral individuals benefit from the trade to guarantee such relationship permanently (Yeung and Tung 1996).

Confucianism strongly supports hierarchy in collective working and signals the importance of the role of leader (Romar 2002). In a Confucian organization, people in the dominating position often demand absolute obedience from the subordinates, not necessarily with symmetrical reciprocity (Ip, 2009), which means equal exchange of duties and obligations. To sum up, we focus on two Confucian attributes, collectivism and hierarchy, to explain its effect on the CE-NPD – performance link.

2.3.2 Taoism

Taoism originated in ancient China more than 2,000 years ago, and its philosophy has become one of the oldest and the most mature belief systems in the world (Lin et al. 2013). Overall, Taoism emphasizes individual freedom and tranquility, and the three cardinal concepts in Taoism are Tao, Freedom, and Wu Wei (Suen et al. 2007).

Tao, Freedom and Wu Wei are mutually reinforcing elements. Tao in the Chinese language means “the road” or “the path of life”. Taoism advocates that people should follow the natural way in order to achieve peace, harmony, and pure happiness, during which process, there should be no “artificial regulation, punishment and ceremonies” (Suen et al. 2007, p. 262). While the Chinese term Wu Wei has been translated into English as non-action, it does not mean that people should not do anything (Tian et al. 2015). Consistent with Tao and Freedom, it means that people should live their lives in a natural way (Tian et al. 2015).

Taoism makes people realize the co-existence of Yin (feminine) and Yang (masculine), named as the duality and contradictions that are innate and inherent in every action of a human being, and nothing can be successful without the duality (Durlabhji 2004). Successful creators are those who can balance each aspect well (Li et al. 2011). Taoism recognizes individual talents and nurtures their creative potential. Nothing and weakness are treated as more effective than the higher term, and they are able to generally oversee the functions of the way of Tao (Lin et al. 2013).

Taoism also stresses Xiaoyao, which is closely related to independence and freedom. This means that people need to take ownership of their actions and be passionate in what they do, irrespective of others' comments (Lin et al. 2013). Under Taoism, people should be humble, and the core learning is people's involvement in and acceptance of what they do, preventing mistakes by absorbing the positive elements in their common life and eliminating the negatives (Qiang 2006). In sum, we focus on the Taoism teachings of Tao, Freedom, Wu Wei and Yin-yang balance to explain its effect on the CE-NPD link.

2.3.3 Confucianism and Taoism in China-related management studies

China national cultural research is gaining increasing popularity due to the fact that most organizational theories developed from the western context are not readily applicable to the Chinese context (Zhao et al. 2006). As two important facets of the Chinese national culture, Confucianism and Taoism have been extensively used to explain phenomena in China-related studies. For example, Guanxi which has its root in Confucianism is a well-established research direction in supply chain management studies (Zhao et al. 2006). According to the findings of Feng et al. (2017), Guanxi significantly relates to operational performance of firms via the role of supply chain integration. Huo et al. (2017) used the Confucianist virtues to explain the relationship between Third-Party-Logistics (3PL) users' dependence and trust. In the NPD context, cultural factors have been widely linked with the success or failure of NPD efforts (Parente et al. 2011). In this study, Confucianism and Taoism are regarded as sources of facilitating factors based on their applicability in the closed loop supply chain context. The previous section suggests that Confucian thought gives priority to cultural and behavioral values such as leadership emphasis and collectivist actions through self-discipline, continuous learning, and hierarchical governance. On the other hand, Taoism anchors on acceptance of nature, peer involvement, freedom, balancing duality, and employee empowerment (Hermsen 1996; Li et al. 2011).

Basically, these two philosophies, when implemented in companies, will engage employees at a grassroots level to understand their responsibilities, nurture creativity considering CE and teamwork, and prevent employees from making mistakes. Soft tools such as philosophical values deal with people issues far better than using structured tools or implementing best-in-class practices, and will engage in tandem employees' hearts and brains to satisfy customer needs (both current and future), NPD process, and performance.

3. Research Model and Hypotheses

3.1 CE-NPD Process and TTM

The ideation stage, as a crucial part of the NPD process, holds the key to the reduction of product development time and costs (Reid and De Brentani 2004). In the context of CE-NPD, the importance of ideation, as a set of key pre-development activities, is further strengthened. Environmental concerns over the products have to be addressed at the earliest stage of NPD in order to prevent any forms of costs that may incur when fixing the environmental consequences of the finished products (Genç and Di Benedetto 2015). Once companies identify the development objectives, the most important thing is to identify customers' needs. It has been widely proven that green/sustainable products are generally needed as the environmental awareness of consumers is increasing. Therefore, companies do not need to spend time on verifying *whether*; what they need to focus on is *how*. Under this condition, if R&D employees with the support of other departments can quickly develop the ideas of new products with CE features, they are likely to achieve a good outcome (Genç and Di Benedetto 2015). However, this is not an easy task as firms will need roughly 3,000 raw ideas to develop one successful new product (Stevens, 1998), and effective selection and prioritization is the key to making more profit from new products developed (Cooper and Kleinschmidt, 1986). According to Cooper and Kleinschmidt (1986), lower TTM is closely linked to product design and development. If the products have high value

and comply with planned CE requirements and objectiveness, it is easier for companies to launch the new product in the marketplace because of high consumer acceptance. In addition, research has widely proven the crucial role of external and internal cross-functional cooperation in the success of NPD projects (McNally et al. 2011). In the context of CE-NPD, external cooperation is likely to be strong between the firm and its suppliers, the government, consumers and other external stakeholders. Similarly, internal cross-functional collaborations are also maximized because of the establishment of NPD project teams comprising of people from different backgrounds. However, it is worth noting that successful cooperation is determined by effective communications, technological support, trust and empowerment (Gmelin and Seuring 2014b).

3.2 CE- NPD Process and Profit

Product innovation has been widely proven to be a crucial source of business revenue and profit. According to Maylor (1997), about 80% of product costs are determined by product design. At the pre-development stage, intangible customer requirements can be transformed into tangible product streams, thereby providing specific objectives for CE-NPD. Kreuzbauer and Malter (2005) point out that the largest contribution of final design is to enhance company brand, and the brand will bring both tangible and intangible benefits to the enterprise, and the intangible benefits will ultimately be translated into substantial corporate assets as well. In the context of CE-NPD specifically, companies benefit from developing “greener” or “more sustainable” products in terms of return on investment, revenue, competitiveness, as well as corporate image (Pujari 2006) through improved efficiency and consumer loyalty (especially from those who are environmentally conscious and willing to pay more for such products). In summary, competitive advantages can be achieved by firms’ CE-NPD efforts (Gmelin and Seuring 2014).

According to the knowledge Based View (KBV), if a firm is able to learn and integrate the relevant CE knowledge effectively into their ideation and

commercialization activities in a way that external replication is minimized, it will achieve superior performance for the new product developed. Based on the discussions above, we propose:

Hypothesis 1 CE-NPD process has a positive effect on TTM.

Hypothesis 2 CE-NPD process has a positive effect on profit.

3.3 The role of Chinese traditional philosophies in the CE-NPD process – performance link

Based on the central idea of the KBV, CE-NPD process is expected to enhance competitive advantage through reduced TTM and improved profit. However, we acknowledge that contextual factors play a substantial role in human knowledge, creativity, and more importantly, the way in which they integrate the knowledge. Existing studies suggest that culture, as a main driving force for performance, has a significant positive effect on enterprise growth in the long run (Yilmaz and Ergun 2008; Chen et al. 2009). It is generally admitted that organizational behavior mirrors social ideology regarding power, trust, loyalty, inspiration, regulation, communication, coordination, uncertainty, and so forth (Shane 1993). Kanter (1982) found that differences in organizational behavior have an effect on successful innovation, and different cultural values in the behavior, to some degree, present national differences in rates of innovation.

According to Li et al. (2011), culture makes it possible for companies to develop their process, provide actions to deal with problems that confront them, and finally promote the organizational process and its achievement. Confucianism and Taoism are believed to have different impacts on Chinese people, entrepreneurship and connection with nature (McGrath et al. 1992). Specifically, Confucianism emphasizes “personal morality, correctness of social behavior, harmony of interpersonal relationships, justice, effective uses of resources and sincerity” (Hue 2007). On the

other hand, Taoism advocates “actions through inaction, the power of emptiness, spontaneity, the strength of softness, respect nature and the relativism of human values” (Hue 2007). As a result, the behavior styles of team members differ under these two opposite philosophies. While the former stresses hard work, harmony, perseverance, and loyalty, the latter advocates natural uncertainty in a flexible way and maintains that the strong can be defeated by compliance (Lin et al. 2013).

Confucianism, as a stimulation factor, ensures business in the long term. It is suggested that the Confucian virtues (benevolence, righteousness, propriety, wisdom, and trustworthiness) provide a moral foundation for the cooperative relationships and the hierarchy in enterprises. Building a strong relationship, or Guanxi, with the right parties can help maintain long-term business in China (Lin 2011). It seems that the right network relationships allow the corporation to better fulfill a financial scheme than those where such relationships are absent (Yeung and Tung 1996). In terms of CE-NPD activities where a high level of cross-functional coordination is required (Pujari 2006; Genc and Di Benedetto 2015), relationship establishment based on the common good and the shared goal enables the timely accomplishment of the set goals. On the other hand, highly hierarchical organizations have a significantly different classification role, like status, job function, and corresponding code of conduct, and stress mutual interests and goal achievement more than self-interest. Employees need to accept and obey organization arrangement and therefore, enable it to focus all resources on CE-NPD activities to guarantee the accomplishment in time. Cooperative culture not only enables collecting information and achieving shared information, but also speeds up the process from idea generation to the final design stage.

Taoism demonstrates human truth in all human activities, including business and management within natural settings. Durlabhji (2004) states that organizations establish living and working areas aiming to accord with the Tao to improve

happiness and harmony. Embodying such thoughts, Taoist leaders tend to comply with the nature of the individuals on the development team (Lin et al. 2013). The openness of company culture has a beneficial effect on NPD performance, on the grounds that it provides researchers with more opportunities to break the behavior restriction, strengthen communication, and increase the speed of transferring information, thereby acquiring more choices and knowledge and dramatically reducing the cost of developing new products and accelerating the development of new product (Chesbrough 2003). Because the role of employees is not specifically defined, there is relatively higher freedom in low-hierarchy organizations. The way of thinking in low-hierarchy companies is less limited from the inter-group, and people are more likely to express their own ideas about the work. In this atmosphere, information can effectively transfer among employees and promote designers to obtain and understand information. Leaders also can make full use of information technologies to make extensive decisions swiftly. Moreover, such a flat and decentralized corporate culture can enable the rapid implementation of new plans and generate more ideas, likely increasing productivity and reducing waste and costs (Hum and Sim 1996). By doing the above practices, the company can increase the speed of launching new product development and acquire more competitive strength than its competitors. As Taoism advocates the harmony between nature and the human, it acts as a stimulation factor which strengthens the effectiveness of CE-NPD activities.

In reality, Confucian and Taoist thoughts coexist in China and are embedded in Chinese people's everyday behavior (Lin, Ho, and Lin 2013). Hence, it makes sense to study the combined effect of these two philosophies on the CE-NPD process – performance link. As they complement each other in various aspects, we propose:

H3: The moderating effect of combined Confucianism and Taoism on the CE-NPD process - TTM link is positive.

H4: The moderating effect of combined Confucianism and Taoism on the CE-NPD process - profit link is positive.

.....Insert Figure 1 here.....

4. Research Methodology

The survey research method was employed for this study. A questionnaire was designed and distributed to private enterprises located in the Yangtze River Delta, one of the most developed regions in China, with a high contribution to national gross domestic product. We selected companies for our study based on the following criteria:

- The company must have patents for their main products with CE-related knowledge;
- The company must own a high-tech certificate granted by the Chinese government; and
- The company must have high R&D investment.

The respondents of our study are employees from the R&D unit, technology unit, or senior management unit of the companies. Our study targets at these people because their daily work is closely related to the NPD process. Before data collection, one of the coauthors explained the concept of CE to the respondents, and clearly expressed that the study was to be conducted with respect to CE-NPD.

4.1 Measures and Survey Procedures

We constructed a structured questionnaire for data collection. All the measures we use for the constructs are adapted from well-established scales. The questionnaire contains five parts with a cover letter describing the aim of the study and the related ethical issues. We derived items of Confucianism and Taoism from Lin et al. (2013). In terms of CE-NPD process, measures for the idea generation activities were based on Swink and Song (2007) and Zhang et al. (2009). Items for the final design stage

were derived from Chapman and Hyland (2004), Hertenstein et al. (2005), and Sheremata (2002). For performance, TTM measures were adapted from Li et al. (2006) and Sheremata (2002) and measurement items for profit are borrowed from Joshi and Sharma (2004). A 7-point Likert scale ranging from 1, “very low,” to 7, “very high,” was applied to the questionnaire. The questionnaire was first developed in English and then translated into Chinese. A back-translation technique was used to ensure equivalence in meaning between both versions (Barger et al. 2010). All the measures are reflective in nature. See Table 1 for the detailed measures employed in this study.

Subjective measures are used for this study, i.e., respondents are required to provide their perceptions for each item on the questionnaire based on their own understanding. Subjective measures are increasingly used in recent research when objective data are not available (Zulkiffli and Perera 2011). Since the majority of the private enterprises in the Yangtze River Delta are SMEs which are not listed on the stock exchange, no publicly available financial data can be obtained. According to Zulkiffli and Perera (2011), subjective measures are appropriate alternatives to their objective counterparts when objective data are difficult to obtain. Subjective data do not necessarily generate less reliable results (Ward et al. 1998), and they are particularly useful when comparing NPD performance across companies from different industries (Genc and Di Benedetto 2015).

.....Insert Table 1 Here.....

4.2 Quantitative Sample Description

130 responses were collected from 37 private enterprises, among which 19 were incomplete, resulting in 111 valid responses. The sample companies are electrical and electronic equipment parts producers and mechanical equipment and auto parts producers. Among these private enterprises, 28 companies are small and medium enterprises (SMEs), while others are listed or large companies. The majority of the

respondents (51.3%) were researchers and designers in their organizations, followed by 7.2% R&D manager assistants, 5.4% general managers, and 5.4% operations managers. All respondents were believed to be knowledgeable regarding new product innovation practices in their own companies. They have either sufficient working experience (4-6 years) in their current position or a decent educational background. More than 45.9% of them have a post-graduate degree or above, and 54.1% of them possess a bachelor degree.

5. Results

Structural Equation Modeling (SEM) was performed for data analysis. Between the two types of SEM, Covariance-based SEM (CB-SEM) and Partial Least Squares SEM (PLS-SEM), we believe that the latter is more suitable for this study. Whereas CB-SEM is used for testing theories, PLS-SEM is more useful to the studies exploratory in nature and is able to do so with smaller sample sizes (Sarstedt et al. 2014). Since this study is exploratory in nature whose primary aim is to develop theory on CE-NPD with a relatively smaller sample size, PLS-SEM is chosen over CB-SEM (Hair et al. 2014). Data analysis was performed using statistical software SPSS 22 and Smart PLS 2.0 Windows version.

5.1 Non-Response Bias

We checked non-response bias by comparing the average values of the objective questions in the first 20 questionnaires collected with those of the remaining responses, which is a commonly used approach to test non-response bias (Zeng et al. 2017). The result of the t test shows no obvious statistical significance (p value > 0.05 , and t value ranges from about -0.7 to 1.2). Thus, non-response bias has small effect on the integrity and validity of the questionnaire.

5.2 Validity

We deleted items with low factor loadings, resulting in 19 items in total. We use average variance extracted (AVE) to measure the convergent validity of

questionnaires. KMO and Bartlett's Test were performed before factor analysis. It can be seen that the coefficient of KMO for all variables are larger than 0.5, and the p values of Bartlett's Test of Sphericity are lower than .005, which indicate that the data is suitable for factor analysis. The AVE values of all variables are above 0.5, indicating adequate convergent validity in the four latent variables. The cumulative variances are larger than 50%.

5.3 Reliability

Internal consistency reliability is presented by Cronbach's α . Cronbach's α is the traditional way to assess the internal consistency of the multiple items in a single construct (Hair et al. 2014). The values of Cronbach's α for the four variables of traditional Chinese no waste philosophies, NPD process with circular economy considerations, TTM, and profit are .8577, .8965, .9002, and .9151 respectively. Since all the values are above .70, we regard the data collected as satisfactory.

Composite reliability was also used to check the internal consistency of items. A value above .7 means an acceptable composite reliability. Table 2 shows the Cronbach's α , composite reliability, and AVE for all the variables. The values indicate an acceptable validity and reliability of the data.

.....Insert Table 2 Here.....

5.4 Results

Figures 2 illustrates the path coefficients for the CE-NPD – TTM and CE-NPD – profit relationships as 0.261 and 0.262 respectively, which means that CE-NPD process has positive effect on TTM and profit. When the role of Confucianism is treated as a moderator, the new coefficient for CE-NPD*Confucianism and TTM slightly increases to 0.281, and that of CE-NPD*Confucianism and profit decreases to 0.127. This means that Confucianism positively moderates the relationships between

CE-NPD process and TTM, but the effect is insignificant. However, the presence of Confucian values weakens the positive link between the CE-NPD process and profit. When Taoism acts as a moderator, the positive impact of CE-NPD process on TTM and profit is largely reduced to 0.078 and 0.216 respectively. To sum up, adaption of either one of the philosophies of Confucianism or Taoism in the organizations influences the outcomes of their CE-NPD process. While Confucianism strengthens the CE-NPD – TTM link, it weakens the CE-NPD – profit link. Taoism, on the other hand, reduces the strength of both links.

.....Insert Figure 2 Here.....

The next stage of analysis combines Confucianism and Taoism, because Chinese people are likely to be simultaneously influenced by both philosophies. Figure 3 shows the path model of CE-NPD process and both TTM and profit. According to the results, the path coefficient between CE-NPD and TTM is 0.256, indicating a slightly positive effect of CE-NPD process on TTM. After the role of combined philosophies is added to the CE-NPD process, the path coefficient becomes .333, which means that combined philosophies of Confucianism and Taoism strengthens the positive impact of CE-NPD process and TTM.

The path coefficient between CE-NPD process and profit is 0.255, indicating a low positive impact of CE-NPD process on profit. When the role of combined philosophies is added, the path coefficient becomes .305, which means Confucianism and Taoism collectively enhance the positive effect of CE-NPD process on profit.

.....Insert Figure 3 Here.....

Table 3 demonstrates the results of the hypotheses testing. It is clear that the path coefficients of CE-NPD process with TTM and profit are 0.261 and 0.262 respectively. With p values of 0.008 and 0.015 respectively, we can conclude that the direct effect of CE-NPD process on performance is positive and significant, which means that

CE-NPD process reduces the NPD time and promotes financial growth. Thus, hypotheses 1 and 2 are supported.

In light of the moderating effect of the traditional Chinese philosophies, when Confucianism and Taoism are analyzed separately, the path coefficient between CE-NPD process*Confucianism and TTM is 0.281 (with a p value of 0.066), slightly higher than the direct CE-NPD process - TTM coefficient, indicating that Confucianism positively moderates the relationship between CE-NPD and TTM. It is worth noting that the significance level of the positive CE-NPD - TTM relationship was reduced when Confucianism was treated as moderator (as indicated in Figure 2), which indicates a weak positive moderating effect of Confucianism. However, when the role of Confucianism is added to the analysis, the positive effect of CE-NPD on profit is weakened from the original value of 0.261 to 0.127, and the p value is 0.411 (above 0.1).

If the role of Taoism is taken into account in the analysis, the positive effect of CE-NPD on both TTM and profit performance is reduced to 0.078 and 0.216 respectively, with p values of 0.605 and 0.172. This suggests that the presence of Taoist values among the NPD team members acts as a negative influencing factor in their work effectiveness measured in terms of both TTM and profit.

When Confucianism and Taoism are combined in the analysis, the path coefficient between CE-NPD process* combined philosophies and TTM is 0.333 and the p value is 0.002 (lower than 0.01). It means that the coexistence of Confucian and Taoist values in NPD workers strengthens the positive effect of CE-NPD on TTM. Similarly, the path coefficient of CE-NPD process*combined philosophies to profit is 0.305 and p-value is .004 (lower than 0.01), which proves that Confucianism and Taoism collectively strengthen the relationship between CE*NPD process and profit. Based on the results, H3 and H4 are also supported.

.....Insert Table 3 Here.....

6. Discussions

Under the national, regional and organizational CE development strategies, NPD with environmental/sustainability/CE considerations is the new trend. In terms of the direct effect of CE-NPD on performance, we found empirical evidence that when firms incorporate CE considerations into the NPD activities, they experience improvements in both speed and profitability. This is a novel insight because in theory, CE-NPD should increase costs and complexity of the development process compared with conventional NPD (Gmelin and Seuring 2014b) due to the extra efforts in market research, technical development, cross-functional coordination and other resources needed. However, our study generates different findings which can be explained by a long-term perspective of sustainability. Practically, firms are encouraged to take a long-term perspective regarding the adoption of CE-NPD activities when they are balancing resource constraints and sustainability. The initial research and development costs can be recovered by market acceptance of the products in the long-run. In terms of TTM, as CE is a common goal for every part of the country, CE-NPD efforts of any firm are actually shared by consumers, suppliers, governments and other stakeholders. It is no longer independent activities of individual firms; instead, the increased level of internal and external cooperation increased the speed of developing and introducing new products to market.

With respect to the role of philosophies, we found empirical evidence that Confucianism plays a positive moderating role in the CE-NPD process - TTM link. However, its moderating effect on the CE-NPD - profit link is negative. This indicates that, in an organization where Confucianism is the mainstream value, the speed of developing new products with CE considerations is increased but the profit associated with the new product is reduced. This finding can be explained by the absolute obedience advocated by Confucian values and the ineffectiveness of internal information transmission caused by hierarchical problems. Since Confucianism stresses positions and responsibility in the organization, a larger confinement effect

for employee behavior could be caused because employees could not flexibly express their own ideas given the limited channel for information exchange and a tendency of not to challenge the authority. The positive side is that orders from top management regarding CE-NPD are usually followed by CE-NPD staff without much questioning and challenging. Thus, TTM can be largely reduced. On the other hand, information sharing within such an enterprise has to go through the complicated hierarchical structure, causing asymmetric information among the staff. Therefore, it is possible that the final product derives from the design, resulting in low consumer acceptance and sales. In addition, the uncertainty avoidance elements in Confucianism potentially harm innovation and performance, which is inconsistent with Nakata and Sivakumar (1996). With limited resources and political ties, Chinese private enterprises tend to follow detailed rules and the leaders usually pursue risk-aversion due to the uncertain economic tendency, which has a detrimental effect on generating novel ideas and realize the economic value of these ideas.

Confucian values such as kindness, never forgetting goals in the face of adversity, harmony, and not competing with others could build a favorable environment for external collaboration, which is crucial for the success of CE-NPD projects (McNally et al. 2011). Under such circumstances, companies are more willing to open their borders and transfer information, thereby boosting CE-NPD speed. However, collectivism in Confucianism has the effect of protecting self-interest of a department, which might lead to conflicts, tensions, and suspicion between cross-functional CE-NPD team members and finally increase the cost of developing new products.

This study also found that Taoist values weaken the positive effect of CE-NPD process on both TTM and profit performance. This means that in organizations dominated by Taoist values, TTM will be increased and profit decreased. Studies in Western contexts suggest that respecting individual difference and autonomy in the working environment can stimulate intellectual development, and this explains why Western countries always value open innovations. However, in China, they do not

enhance the performance of the firms. According to Hofstede (1980), the management theories drawn in Western countries may not be equally applicable to the Chinese context due to the different cultural backgrounds. Since China values collectivism with a cultural identity of long-term orientation, working together with peers under the supervision and guidance of the superior is a common practice for most Chinese people. Though high autonomy and flexibility in working can be beneficial for future success, short-term efficiency could be reduced by a lack of centralized management, resulting in less favorable outcomes. Moreover, as commonly acknowledged, organizations with less formal control from the management tend to have more radical innovations, but at the same time it is more risky for such organizations to drift away from the designated path of development. For CE-NPD projects, there must be a certain level of central control.

The combination of Confucianism and Taoism values was found to be the most effective moderator in the CE-NPD process and performance link. This result comes from the complementarity between Confucianism and Taoism. While Confucianism stresses hard work in a hierarchical world, Taoism emphasizes the natural way. Their coexistence avoids both absolute submission to authority and absolute autonomy in the CE-NPD project teams of the company. CE-NPD activities generate optimal outcomes when the working culture reaches a balance between these two states. In this context, CE-NPD staffs follow the guidance from management and cooperate with colleagues harmoniously with a certain level of autonomy. Idea generation and information transfer are boosted in such an environment, leading to the quick development of new products which are well accepted by consumers.

7. Contribution and Implications

7.1 Contributions

This study contributes to the NPD literature in two ways. Firstly, it found empirical evidence on the positive direct link between the new trend of NPD which reflects various CE considerations and both TTM and profit performance. Companies can reduce TTM and enhance profit by engaging in efficient idea generation activities and final product design. If the ideas are creative and valuable for customers and the final products contain all the planned characteristics, the new product with CE features is likely to gain successful access to the market and bring economic benefits to companies. This finding adds value to the current “whether it pays to go green” debate (Dowell and Muthulingam 2017) from the perspective of NPD.

The most valuable contribution of this study is how traditional Chinese philosophies can, as a moderator, strengthen the relationship between CE-NPD process and performance. It seems that the best combination of Confucian and Taoist values in people is the most effective facilitator of successful CE-NPD projects. Confucianism guides people to strictly follow the detailed roadmap to develop the new product and introduce it to the market under a friendly working environment. This planning mechanism and friendly environment can largely help avoid mistakes and provide opportunities for companies to research the development of high-quality products with shorter life cycles, which is a significant advantage for firms. At the same time, Taoism provides a flexible environment that encourages NPD teams to express their own ideas, helping firms better understand the market and customers’ requirements. The result explains why ancient China had a strong powerhouse and developed more inventions than it does now as the influence of these ancient philosophies in Chinese people is getting weaker. The innovation capability of China was slowed down in recent decades because of the increased impact of Western cultures and less importance given to traditional culture and philosophies. Therefore, Chinese private enterprises should not neglect the promotion of traditional cultural values in their NPD projects. They should make the most of them to motivate and empower their NPD team members to perform tasks based on preset plans and, at the same time, give

them the room and freedom to be creative. The coexistence of Confucian and Taoist values optimizes the CE-NPD outcomes.

7.2 Managerial implications

In terms of practical implications, Chinese private enterprises are encouraged to confidently shift their NPD focus to CE-NPD in spite of the possible costs increase that may incur at the beginning of this change. However, they do need to conduct sufficient research to identify CE opportunities and understand customer needs first as successful NPD must produce something that the market needs and wants. It is also necessary for the firms to establish a favorable environment for creativity and innovation. They should pay closer attention to the management of employees' morale to achieve goals and build a favorable working environment with cooperation among colleagues. They also need to acknowledge and respect employees' individual differences and help those who lack self-confidence in work. Companies are advised to communicate frequently with the R&D employees to understand the real working situation and solve conflicts in time to guarantee effective information transfer, which facilitates decision-making effectiveness for companies and stimulates work enthusiasm among the designers and researchers, ultimately contributing to performance improvement. More importantly, companies must sufficiently motivate individuals to develop new products, since the working ability of individuals largely depends on the leadership with resource sharing. Therefore, it is important for leaders to respect the technical personnel's self-esteem and have enough trust in them. Leaders need to treat staff equally and give them a certain level of autonomy in the CE-NPD process, which helps provide a flexible environment for new product development, accelerate the speed of innovation, and increase profit in the long run. In a word, it is a challenge for the management to keep a balance between central control and empowerment to improve CE-NPD performance.

7.3 Future research directions

Although this study has generated some meaningful results, there are still certain limitations to be further addressed. Firstly, this study might have not considered the results of some relevant attributes that may be related to CE-NPD projects. For example, the type of CE-NPD project and innovation are likely to influence the degree of NPD team abilities, thereby having an effect on performance. More attention is required in this aspect in follow-up studies. Furthermore, due to the limited number of samples and regions in this study, the results may not be able to represent all private enterprises in China. Hence, to some degree, it affects the generalizability of research results. Finally, Chinese traditional philosophies are broad and profound, and far more complicated than the measures utilized in this study. Therefore, more systematic and comprehensive research is needed when investigating these philosophies in the future.

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Figures

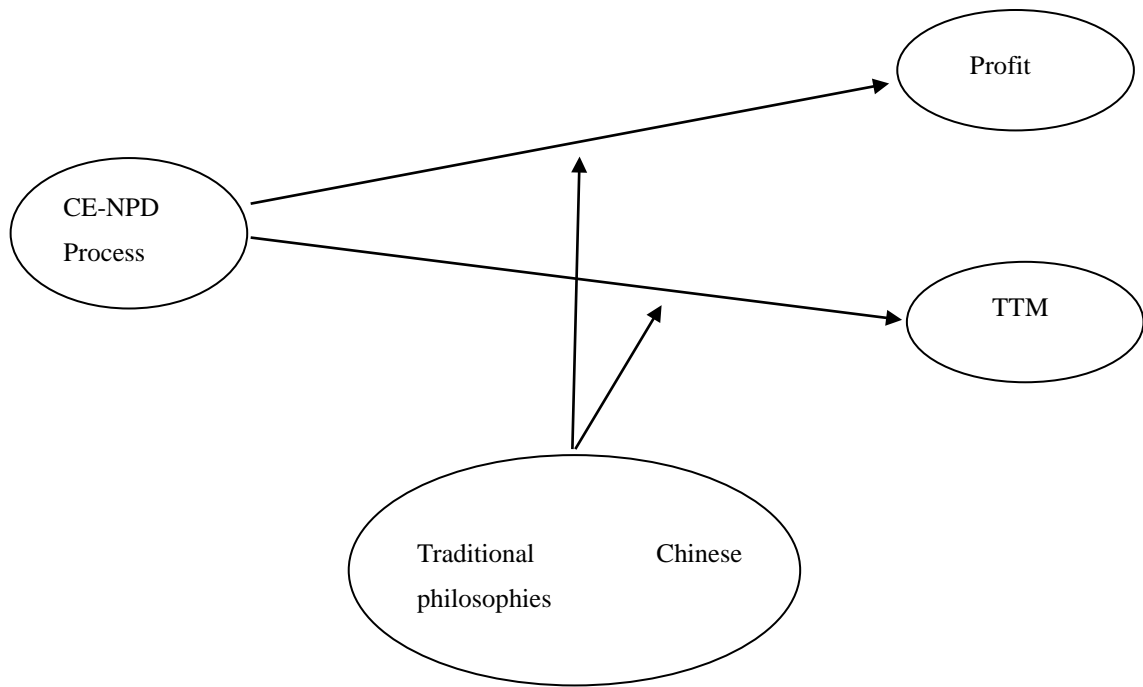
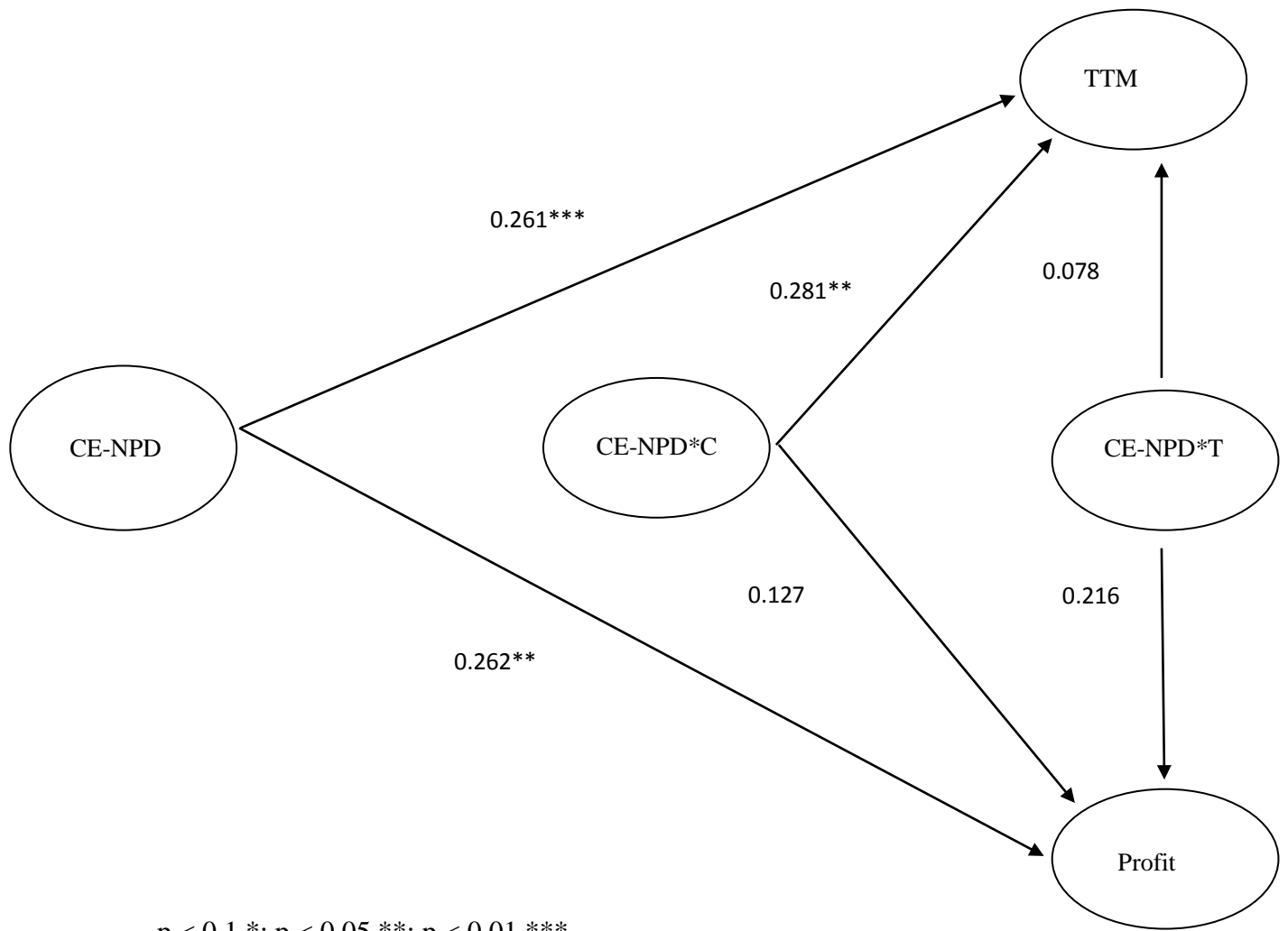


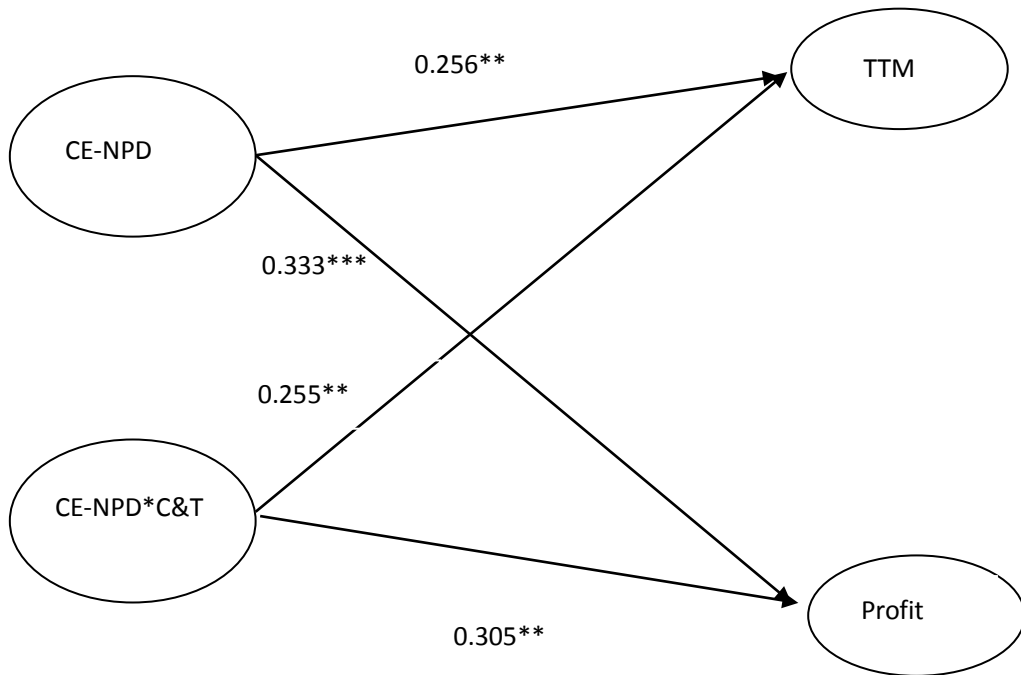
Figure 1: Research Model



p < 0.1 *; p < 0.05 **; p < 0.01 ***

(C: Confucianism; T: Taoism)

Figure 2: Moderating effect of Confucianism and Taoism



$p < 0.1$ *; $p < 0.05$ **; $p < 0.01$ ***

(C&T: Confucianism and Taoism combined)

Figure 3: Moderating effect of combined Confucianism and Taoism philosophies

Tables

Table 1: Measures

Constructs	Variables	Mean
Confucianism	C1 How far hierarchical structure affects CE-NPD	3.89
	C2 You never forget your goals even in the face of adversity	4.25
	C3 The levels of uncertainty avoidance in decision-making	3.76
	C4 You take responsibility to act benevolently in inter-relationships	4.91
	C5 Employees' loyalty is helpful to CE-NPD projects	4.97
	C6 Employees' harmony is helpful to CE-NPD projects	5.01
Taoism	T1 CE-NPD team members respect individual difference among others	4.15
	T2 Members are treated equally in CE-NPD teams	4.37
	T3 People are willing to do what their superior tells them to do without arguing	4.58
	T4 Leader give subordinates autonomy to do their work without intervention in CE-NPD projects	4.54
	T5 Team members do not compete with others in CE-NPD projects	4.12
Idea generation	IG1 CE-NPD teams do detailed market research with respect with CE trends and developments	5.14
	IG2 Company encourages creation of new ideas based on CE considerations	5.13
	IG3 CE-NPD team members quickly capture CE trends in customer requirements	4.67
	IG4 CE-NPD employees frequently interact with customers to set reliability, responsiveness, and other standards for us	4.15
	IG5 Team members quickly convert product ideas with CE considerations into products	4.03
Final design	FD1 Technical complexity of CE-NPD projects	4.20
	FD2 Completed products include all planned CE features	4.99
	FD3 Completed products meet all reliability objectives in CE-NPD	5.03
	FD4 NPD team design the products have high value with respect to CE requirements	3.86
	FD5 The effectiveness of cross-functional team in product development	4.87
TTM	TTM1 CE-NPD team delivers product to market quickly	3.77
	TTM2 Company is first in the market in introducing new products with CE features	4.71
	TTM3 Time-to-market in your company is lower than industry average	5.04
	TTM4 NPD team has fast product development with CE considerations	5.00
	TTM5 New product available to all customers on its targeted delivery date (1=very late, 7=very early)	4.01
Profit	Profit 1 Profitability of the new products in the past three years	4.82
	Profit 2 Sales of the new products in the past three years increase	5.05
	Profit 3 Market share of the new products in the past three years	4.70

Table 2: Validity and Reliability

Variable scale			Number of items	Cronbach's α	Composite Reliability	AVE
Traditional Chinese philosophies	Confucianism		4	0.858	0.891	0.540
	Taoism		3			
CE-NPD process	Idea generation stage		3	0.897	0.920	0.658
	Final design stage		3			
Performance	TTM		3	0.900	0.937	0.832
	Profit		3	0.915	0.946	0.855

Note: All indexes are significant at $p < 0.05$

Table 3: Construct relations and significance

Relationship between constructs	Path Coefficient	P value	Results
CE-NPD process and TTM	0.261	0.008	CE-NPD process reduces TTM
CE-NPD process and profit	0.262	0.015	CE-NPD process increases profit
CE-NPD process*Confucianism and TTM	0.281	0.066	Confucianism slightly strengthens the positive impact of CE-NPD on TTM
CE-NPD process*Confucianism and profit	0.127	0.411	Confucianism weakens the positive impact of CE-NPD on profit
CE-NPD process*Taoism and TTM	0.078	0.605	Taoism weakens the positive impact of CE-NPD on TTM
CE-NPD process*Taoism and profit	0.216	0.172	Taoism weakens the positive impact of CE-NPD on profit
CE-NPD process*philosophies combined and TTM	0.333	0.002	Combined Chinese traditional philosophies strengthen the positive impact of CE-NPD process on TTM
CE-NPD process*philosophies combined and profit	0.305	0.004	Combined Chinese traditional philosophies strengthen the positive impact of CE-NPD process on profit