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Marketing and supply chain coordination and intelligence quality: a product innovation performance perspective

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ABSTRACT

Based on a sample of 148 Swedish firms, this study investigates the complementary relationships between internal and external coordination and external intelligence quality to explain product innovation performance. The results show that, with increasing manufacturing-marketing coordination, higher market intelligence quality or higher supply chain intelligence quality are positively associated with product innovation performance. The complementary roles of internal and external coordination and intelligence quality have theoretical and practical implications.

Keywords: market intelligence quality; supply-chain; coordination; Sweden

1. Introduction

With increasing competition and accelerating industry clockspeeds, firms are under increasing pressure to develop new products to address market needs (Hobday, 1998; Katzy, Turgut, Holzmann, & Sailer, 2013; Yam & Chan, 2015). Both external and internal coordination are increasingly central to scanning and acquiring knowledge from the environment and then transforming and exploiting such knowledge for innovation efforts. Internal coordination between functions of marketing (Henard & Szymanski, 2001; Swink & Song, 2007) and manufacturing (Alegre-Vidal, Lapiedra-Alcamı, & Chiva-Gómez, 2004; Tatikonda & Montoya-Weiss, 2001) leverages knowledge to pursue innovation goals. Manufacturing coordination with marketing refers to "an affective, volitional, mutual/shared process where [marketing and manufacturing], have mutual understanding… [to] achieve collective goals" (Kahn, 1996, page 57). External coordination with supply chain members is also central to developing a deeper understanding of the market, improving product quality, improving competitive capabilities (Mostaghel, Oghazi, Beheshti, & Hultman, 2015), and decreasing costs and product cycle time (Chang, 2017). Supply chain coordination is related to innovation (Atuahene-Gima, 1996; Bellamy, Ghosh, & Hora, 2014), improved market orientation (Tsai, Chou, & Kuo, 2008), and increased knowledge integration (Craighead, Hult, & Ketchen Jr, 2009). Research and anecdotal evidence highlight the benefits of internal and external coordination in designing and developing products.

Marketing-manufacturing coordination enhances market knowledge, enables firms to manage complex and tacit customer preferences (Baker & Sinkula, 2005), and improves alignment with manufacturing capabilities (Von Hippel, 1998). Manufacturing-supply chain coordination improves design insights and accelerates the pace of product development (Bellamy et al., 2014). Manufacturing-supply chain coordination facilitates on-time product launch, provides stronger placement of new products, and ensures better compliance with product specifications (Alegre-Vidal et al., 2004). We posit that market intelligence quality and supply chain intelligence quality complement manufacturing-supply chain coordination to improve product innovation performance. This performance is defined as the degree to which innovation meets a firm's sales, market share, and customer satisfaction targets. The term new product refers not only to new products and new product lines but also to modifications and derivatives of previous products and product lines (Li & Atuahene-Gima, 2001). The motivation for the complementary effects of intelligence quality on coordination is based on the following aspects.

First, despite the substantial contributions of previous studies on product innovation performance (Olson, Walker, Ruekerf, & Bonnerd, 2001), the results regarding the links between supply chain integration and product innovation performance are mixed (Chang, 2017). Coordination between marketing and manufacturing may not necessarily lead to innovativeness, because it could lock the firm with its current customers and distract their focus with new waves of technology and market change (Augusto & Coelho, 2009). One stream of literature empirically illustrates that manufacturing-supply chain coordination does not improve product innovation performance; for instance, Belderbos, Carree, and Lokshin (2004) examine a sample of manufacturing firms in the Netherlands and find that manufacturing-supply chain coordination is not positively associated with innovation performance. In addition, literature has revealed that higher levels of manufacturing-supply chain coordination improve design performance only and not market performance (Wong, Boon-Itt, & Wong, 2011).

Second, in line with the role of intelligence quality, Maltz and Kohli (1996, p. 48) define market intelligence quality as "the extent to which a person perceives the market intelligence received from a sender as being accurate, relevant, clear, and timely." Market intelligence quality facilitates knowledge about rivals and market activities (Montgomery & Weinberg,

1979) and provides understanding of the latent customers' needs (Jing Zhang & Duan, 2010). Research shows that market intelligence quality mediates the relationship between marketing-manufacturing coordination and new product development performance (Bendoly, Bharadwaj, & Bharadwaj, 2012). However, the moderating role of market intelligence quality in the relationship between marketing-manufacturing coordination and product innovation performance has not yet been investigated.

Third, supply chain intelligence quality could be an important factor in explaining the mixed findings on the influence of manufacturing-supply chain coordination on product innovation performance. Supply chain intelligence quality "reflects the accuracy, relevance, timeliness, and novelty of the information gleaned by a firm through its network of supply-chain partnerships" (Bendoly et al., 2012, p. 655). The extant research has emphasized the importance of supply chain intelligence quality in explaining superior firm performance (e.g., Hult et al., 2007 and Craighead et al., 2009). However, the findings on supply chain intelligence quality and product innovation performance association remain mixed. For instance, Bendoly et al. (2012) show that supply chain intelligence quality does not mediate the effect of manufacturing-supply chain coordination on new product development performance.

This study fills these research gaps by investigating the complementary roles of market intelligence quality and supply chain intelligence quality with marketing-manufacturing coordination and manufacturing-supply chain coordination, respectively. Coordination entails the management of existing resources. While internal (Olson et al., 2001) and external coordination (Swink & Song, 2007) are central to improving innovation outcomes, innovation efforts require novel resource re-combinations that require a firm to go above and beyond the routine coordination efforts. To achieve product innovation performance (Luca & Atuahene-Gima, 2007), a firm must be able to assess and evaluate emerging customer needs through supply chain intelligence and improved market intelligence. Extending this work, we propose that, instead of being a structural mediator, intelligence quality could be a moderator. As the definition of intelligence quality suggests, because the quality of information could vary in coordination efforts, the variation in intelligence quality may better be justified as a moderator. Drawing on the marketing and supply chain literature and based on the knowledge-based view (Grant, 1997) and contingency theory (Donaldson, 2001), this study conceptualizes and empirically tests whether two different sources of knowledge – market intelligence quality and supply chain intelligence quality – buttress the relationships of marketing-manufacturing coordination or manufacturing-supply chain coordination with product innovation performance, respectively. Figure 1 presents the conceptual model.

Insert Figure 1 about here

The remainder of the study is organized as follows. In section 2, we discuss the literature on the relationships among operations, marketing, and supply chain and develop hypotheses relating to the coordination and intelligence quality and product innovation performance. In section 3, we describe our research methodology. Thereafter, in section 4 we present the empirical analysis and results. In section 5, we discuss research findings, theoretical and empirical implications, limitations, and suggestions for future research.

2. Theoretical background and hypotheses development

Manufacturing coordination has been practiced and emphasized by scholars and practitioners for many years (Huo et al., 2015). Coordination is defined as management of the dependencies, such as shared resources and task assignments (Malone & Crowston, 1994). Table 1 illustrates a compendium list of key works on coordination and innovation performance. These empirical studies consider marketing coordination with R&D or operations during different stages of product development process (Olson et al., 2001), complemented by different levels depth, breadth, and tacitness of knowledge (Luca & Atuahene-Gima, 2007). This review broadly suggests that coordination in the early stages with suppliers improves product innovation performance (Petersen, Handfield, & Ragatz, 2005); second, market knowledge depth has a positive association with product innovation performance. The knowledge integration mechanism mediates the relationship between market knowledge specificity and cross-functional coordination to improve product innovation performance (Luca & Atuahene-Gima, 2007). In conclusion, coordination is central to product innovation performance; however, the results are not consistent across the reviewed studies.

Insert Table 1 about here

These inconsistent results suggest that other factors may moderate the relationship between coordination and product innovation performance. The existing literature has examined its relationship with product innovation performance, with limited attention to the possible moderating role of market intelligence quality. The motivation for using intelligence quality is rooted in the knowledge-based view, emphasizing the strategic role of knowledge as a resource for manufacturers (Kogut & Zander, 1992). Overall, our study highlights the position of intelligence quality from an internal source of the marketing department and an external source of supply chain members.

2.1. Market intelligence quality

A significant body of marketing literature sheds light on the responsibilities of the marketing function for identifying, anticipating, and satisfying customer needs (Varadarajan, 2010). Coordination between marketing and manufacturing is an important vehicle for uniting efforts and vision among various innovation-related subsystems (Barki & Pinsonneault, 2005; Mentzer et al., 2001).

Manufacturing marketing coordination refers to the extent of the mutual understanding between manufacturing and marketing departments regarding each other's capabilities and skills and the degree to which they plan and align their aims and activities based on their shared understanding. This internal coordination between manufacturing and marketing functions empowers the transformation of complex and tacit information about customer needs to enhance innovation performance (Tuli, Kohli, & Bharadwaj) by providing them with information about customer needs, market activities, and competitors. This coordination empowers firms to cope with market changes faster. Market potential, marketing task proficiency, product meeting customer needs, and order of entry are among the key antecedents of new product development success (Henard & Szymanski, 2001).

Some studies have confirmed that market intelligence quality partially mediates the relationship between marketing-manufacturing coordination and product innovation performance (Bendoly et al., 2012), and others have illustrated that market intelligence quality fully mediates the relationship between marketing-manufacturing coordination and product innovation performance (Luca & Atuahene-Gima, 2007). The main hypothesis of this study is that manufacturing coordination does not directly affect product innovation performance unless it is effectively complemented by intelligence quality. Market intelligence quality, under increasing manufacturing-marketing coordination, could differentiate firms' offering in comparison to their rivals (Bendoly et al., 2012) and manage demand turbulence (Junfeng Zhang, Hoenig, Di Benedetto, Lancioni, & Phatak, 2009) by improving product innovation performance.

The logic for the proposed hypothesis on moderating is rooted in contingency theory. Based fit-as-moderation (Venkatraman, 1989), contingency theory suggests that both a firm's strategic behavior and its internal and external environmental conditions drive firm performance (Atuahene-Gima & Murray, 2004). Based on the fit-as-moderator between marketing-manufacturing coordination and market intelligence quality, contingency theory supports the moderating role of intelligence quality on the relationship between manufacturing coordination and product innovation performance. Previous research on the importance of market intelligence quality have also called for consideration of market intelligence quality as a moderator (Atuahene-Gima, 1996; Atuahene-Gima & Murray, 2004; Jing Zhang & Duan, 2010).

Based on these arguments, we posit the following hypothesis:

H1. With increasing manufacturing-marketing coordinating, higher market intelligence quality is more positively associated with product innovation performance.

2.2. Supply chain intelligence quality

Previous research demonstrates that a path to a successful and speedy product development is rooted in tacit knowledge exchanges with supplier and customers (Handfield, Ragatz, Peterson, & Monczka). Manufacturing supply chain coordination, which complements the functional strengths of supply chain partners, is one of the crucial antecedents of successful innovation performance (Hult, Ketchen, Cavusgil, & Calantone, 2006). Managers are increasingly seeking improved supply chain coordination in order to deal with the uncertainties of developing and producing innovative products (Bodas Freitas & Fontana, 2018). SCI would enhance their access to sticky knowledge (Von Hippel, 1994) and expand communication and trust between parties in innovation efforts (Bodas Freitas & Fontana, 2018).

Academic studies have increasingly focused on supply chain intelligence quality (Frohlich & Westbrook, 2001; Nagurney, Cruz, Dong, & Zhang, 2005) as a mode for effective long-term coordination with supply chain members (Frohlich & Westbrook, 2002). Supply chain intelligence quality contributes to the performance of innovative products and services by improving understanding of customer needs and aligning them with the skills and capabilities of suppliers to improve innovation performance (Im & Rai, 2008). The empirical study by Köhler, Sofka, and Grimpe (2012) on 5,000 firms in five Western European countries reveals that supply chain intelligence quality impacts product innovation performance only if the innovation is new to the market and not if it is an imitated product. For instance, the study of Bendoly et al. (2012) reveals that supply chain intelligence quality does not mediate the relationship between manufacturing-supply chain coordination and new product development performance. While previous research does not agree regarding the role of supply chain intelligence quality in relation to product innovation performance, additional inquiry is warranted through the lens of manufacturing-supply chain coordination. Thus, based on the contingency theory, we formulate the following hypothesis:

> **H2.** With increasing manufacturing supply chain coordination, higher supply chain intelligence quality is more positively associated with product innovation performance.

3. Methods

3.1. Data collection and sample

To test the proposed hypotheses, we draw on two data sources: a 2014 postal survey of manufacturing firms and archival data of firm financial performance. We draw on a sample from Swedish manufacturing firms for two reasons. Firstly, according to the 2015 European Innovation Scoreboards Project for the European Commission, Sweden has been a leader in innovation and technology since 2007. This setting provides an ideal platform to understand the innovation dynamics of Swedish firms. Secondly, as the outcome variable is an aspect of product innovation performance, it adds to the reliability to control for firm-related characteristics from archival sources. The Swedish government requires firms to file annual reports certified by a chartered accountant. This adds validity to the performance outcomes, which are controlled for in our study.

During the pilot-testing phase of the survey, the questionnaire was pre-tested with four CEOs from manufacturing firms and four academic researchers. Based on the feedback during the pilot testing, the questionnaire was adapted by adding clarifications and changing the order of scale items. A random sample of 1,000 firms with more than 20 employees was drawn from Infotorg Företag, a Swedish database with archival financial information on firms. The questionnaire and a cover letter explaining the purpose of the study were addressed to the CEO or R&D manager of the firm in 2014. After the initial mailing and an additional wave of reminder letters and phone calls, from the sample of 1,000 firms, six questionnaires were undeliverable by the postal service, and 40 firms refused to participate in the study. Of the remaining 954 firms, we received 148 complete responses (16.14% percent response rate).

Table 2 presents the respondents' characteristics in the study. The majority of firms had less than 99 employees, 23.4% of respondents were CEOs, the average years of experience at the company was 11.19 years, and the average experience in the industry was 15.87 years.

Insert Tables 2 about here

3.2. Measures

All of the measures in this study are adapted from the literature. Table 3 illustrates the complete listing of the scale items for each measure.

3.2.1. Dependent variable

Product innovation performance is a 10-item scale proposed by (Talke & Colarelli O'Connor, 2011) and Bendoly et al. (2012) that includes the successful achievement of targeted sales, market share, competitive advantage, and customer satisfaction from product innovation. Table 3 provides a detailed listing of the scale items. All item loadings were significant at $p < 0.01$ or below.

3.2.2. Predictor variables

Manufacturing-marketing coordination (MMC) and manufacturing supply chain coordination (MSC) are both adapted from Bendoly et al. (2012). Each is a six-item scale on the coordination between functions (Cronbach's alpha for MMC = 0.72 and MSC = 0.80).

3.2.3. Moderating variables

The two moderating variables are market intelligence quality and supply chain intelligence quality, adapted from Maltz and Kohli (1996) and Bendoly et al. (2012). Market intelligence quality is measured on an eight-item scale (Cronbach's alpha = 0.79), and supply chain intelligence quality is on a nine-item scale (Cronbach's alpha = 0.87).

3.2.4. Control variables

To decrease the effects of rival explanations, we control for whether the product was licensed and whether the product was patented. Next, several firm-related characteristics could influence product innovation success. From the archival data, we include averages from 2011 to 2014 for the number of employees, assets, and return on assets. We also control for sales growth from 2011 to 2014.

Insert Table 3 about here

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4. Results

Table 4 presents the means, standard deviations, and pairwise correlations. The two predictors (manufacturing-marketing coordination and manufacturing-supply chain coordination) and the two moderators (market intelligence quality and supply chain intelligence quality) were positively and significantly correlated with product innovation success. Using only the direct effects of the regression, all variance inflation factors were at or below 1.87, and the mean-variance inflation factor was 1.52.

The ordinary least squares (OLS) estimates are presented in Table 5. Hypothesis 1 proposed that, with increasing marketing-manufacturing coordination, higher levels of market intelligence quality would be more positively associated with product innovation performance (Model 3: $\beta = 0.920$, $p < 0.01$). Figure 2A supports this hypothesis; however, lower market intelligence quality, despite increasing marketing-manufacturing coordination, could lower product innovation performance. The inference here is that marketing-manufacturing coordination is beneficial to product innovation performance when market intelligence quality is high, or in other words, increasing marketing-manufacturing coordination may not be beneficial unless higher levels of market intelligence quality are present.

Related to Hypothesis 2, with increasing manufacturing-supply chain coordination, higher levels of supply chain intelligence quality are more positively associated with product innovation performance (Model 4: $\beta = 0.929$, $p < 0.01$). As presented in Figure 2B, this hypothesis is conformed.

Insert Tables 4-5 and Figure 2 about here

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5. Conclusion

The extant literature has identified and tested different factors influencing product innovation performance; however, to our knowledge, this study is among the first to consider the complementary effects of marketing-manufacturing coordination and market intelligence quality and of manufacturing supply chain coordination and supply chain intelligence quality on product innovation performance. This study adds to the body of marketing, operations, and supply chain literature by explicating the complementary effects of intelligence quality as a determinant of successful product innovation performance. The results show that higher levels of intelligence quality, or valid and timely information, increase product innovation performance. These findings emphasize the vital role of intelligence quality in leveraging marketing and supply chain coordination. As suggested by Figure 2, marketing-manufacturing coordination and manufacturing-supply chain coordination are necessary but may not be fully sufficient to enhance product innovation performance. Thus, managers and practitioners must allocate adequate resources to obtain and disseminate high-quality information between internal and external units in order to achieve successful product innovation performance.

This study has several limitations. First, this study focuses on the manufacturing firms in Sweden; thus, future research could investigate the role of intelligence quality on the studied constructs and their relationships from suppliers' and customers' perspectives in non-manufacturing and/or in non-Swedish contexts. Second, our measure of product innovation performance was based on self-reported data. Although we control for performance data from archival sources, future studies could draw on archival measures of innovation performance. Third, the context of this study can be considered a limitation; since Sweden has been a leader for innovation in Europe since 2007, this provides companies access to the necessary infrastructure for establishing and maintaining higher levels of coordination. Technology has been identified as a necessity for supply chain coordination, and Swedish firms have access to a large variety of them (Mostaghel et al., 2015). Thus, future studies can choose a context with different levels of infrastructure. Finally, whereas this study used cross-sectional data, future research could use the longitudinal study to investigate the role of intelligence quality in product innovation performance over time.

In conclusion, manufacturing and supply chain coordination is increasingly central to innovation performance. While such coordination is essential to developing new products and extending existing ones, intelligence quality can play an important role in complementing these coordination efforts. Our results show that manufacturing-marketing coordination and market intelligence as well as manufacturing-supply chain coordination and supply chain intelligence quality jointly enhance product innovation performance. The complementary roles of coordination and intelligence quality have implications for the marketing and operations literature.

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Table 1.
A list of key studies on manufacturing coordination and product innovation performance.

Study	Sample Description	Measures used	Theories used	Key Findings	Key extension
(Luca & Atuahene-Gima, 2007)	**China**, **363** high-technology firms (90% Marketing or Sales managers, 4% CEO and 6% Product Development Manager) with RR of **48%**	1. Market Knowledge breath (MKB) 2. Market Knowledge depth (MKD) 3. Market Knowledge tacitness (MKT) 4. Market Knowledge specificity (MKS) 5. Knowledge integration mechanisms (KIM) 6. Cross-functional collaboration (CFC) 7. Product innovation performance (PIP) 8. Technological uncertainty 9. Organizational slack 10. Radical innovation	Contingency theory and the knowledge-based view	1. MKS and CFC affect PIP through KIM. 2. MKD has **a direct (unmediated)** effect on PIP. 3. Effects of MKD and CFC on PIP are negatively moderated by KIM 4. The findings indicate that previous studies may have provided an overly optimistic view of the value of CFC in PIP.	Despite theoretical support for the mediating role of KIM, results showed that MKD has a direct effect on PIP. There are many other integrative mechanisms that may be considered in future studies.
(Olson et al., 2001)	Multiple respondents: 1) project manager or team leader 2) team members of the NPD project connected to marketing, operations or R&D From Fortune 500 only **9** firms participated from different industries	1. Relevant prior experience (RPE) 2. Project Performance (PP) 3. Dyadic cooperation measures: 4. Marketing (MAR)-operations (OPE)- early 5. Marketing-operations- late 6. Marketing-R&D- early 7. Marketing-R&D- late 8. Operations-marketing- early 9. Operations-marketing- late 10. Operations-R&D- early 11. Operations-R&D- late 12. R&D-Marketing- early 13. R&D-Marketing- late 14. R&D-operations- early 15. R&D-operations- late	Resource dependency theory	1. Functional cooperation increases as the process move from early to late stages. 2. Cooperation between MAR and R&D is highest during early stages compare to late stages. It is vice-versa for cooperation between MAR and OPE plus R&D and OPE. 3. Late stage cooperation between MAR and OPE and R&D and OPE is a key determinant in project performance	The cooperation parties, the timing, and nature of the products determine the success of the product performance.
(Swink & Song, 2007)	Total of **467** completed NPD projects	1. Marketing-manufacturing integration (MMI) 2. NPD project length (NPDPL) 3. New product competitive advantage (NPCA) 4. NPD project return on investment (NPDPROI)	Resource dependency theory	1. NPCA mediates the relationship between MMI and NPDROI 2. NPDPL does not significantly impact NPDPROI	Important moderators are neglected in this study
(Tatikonda & Montoya-Weiss, 2001)	A cross-sectional sample of **120** completed development projects. From project managers and second qualified respondents	1. Market outcomes (MO) 2. Market and environmental uncertainty (moderator) 3. Operational outcomes (OO) 4. Technological uncertainty (moderator) 5. Organizational process factors (OPF)	Resource-based view and organizational information-processing theory	1. Achievements of OO aids achievements of MO	Technological uncertainty and external uncertainties are not moderating the relationship of OPF and OO.
(Petersen et al., 2005)	From purchasing/ sourcing managers and executives of **134** firms around the world. Out of 225 invited firm (RR=60%)	1. Detailed supplier assessment 2. Technical Assessment 3. Business Assessment (BA) 4. Project team effectiveness (PTE) 5. Firm financial performance 6. Design performance (DP)	Transaction cost economics, rational theory, organizational design theory, and network governance models.	1. PTE had a greater effect on DP for suppliers who were integrated earlier in the new product development process.	BA does not impact the project team effectiveness.

Note: RR= Response Rate

Table 2.
Respondent characteristics

Characteristics		Percentage
Number of Employees	20-49	38.5
	50-99	29.0
	100-199	13.9
	200-499	14.3
	500-999	2.0
	1000-1499	1.2
	1500-1999	.8
	4000-4999	.4
Position of respondents	CEO	23.4
	R&D Manager	15.1
	CTO	6.7
	Product Managers	2
	Others	6.4
	Not available/unknown	46.4
Years of experience at the company (N=134)	Min 1 and Max 42	
	Mean 11.19 and SD 10.03	
Years of experience in the industry (N=134)	Min 1 and Max 45	
	Mean 15.87 and SD 11.11	

Table 3.

List constructs along with the items

Constructs	Items	Adapted from
Market Intelligence Quality (MIQ)	**Our marketing/sale contacts successfully facilitated following market intelligence activities** **MIQ1**…provided valid estimates of the market **MIQ2**…provided accurate information **Communicated important details about customer needs** **MIQ3**…provided the data necessary to estimate the size of the market for our product. **MIQ4**…presented their ideas clearly **MIQ5**… presented their ideas in a timely manner **MIQ6**…provided real-time updates of changes in the market **MIQ7**…provided novel information with regard to the customers and the market **MIQ8**…gave information that was new and interesting w.r.t. the customer and the market	Maltz and Kohli (1996)
Manufacturing-Marketing Coordination (MMC)	**We had processes to ensure that** **MMC1**…our manufacturing plans/solutions were marketing-aligned **MMC2**…marketing input was used in developing manufacturing plans and solutions **MMC3**…our marketing plans/solutions were manufacturing-aligned **MMC4**…manufacturing input was used in developing manufacturing plans and solutions **Employees engaged in** **MMC5**…marketing understood the importance of manufacturing to our business **MMC6**…manufacturing understood the importance of manufacturing to our firm	Bendoly et al. (2012)
Supply Chain Intelligence Quality (SIQ)	**Our supply chain partners successfully facilitate following intelligence activities** **SIQ1**…provided valid estimates of the market **SIQ2**…provided accurate information **SIQ3**…communicated important details about customer needs **SIQ4**…provided the data necessary to estimate the size of the market for our product **SIQ5**…presented their ideas clearly **SIQ6**… presented their ideas in a timely manner **SIQ7**…provided real-time updates of changes in the market **SIQ8**…provided novel information with regard to the customers and the market **SIQ9**…gave information that was new and interesting with regard to the customer and the market	Maltz and Kohli (1996)
Manufacturing-Supply Chain Coordination (MSC)	**We had processes to ensure that** **MSC1**…our manufacturing plans/solutions were supplied chain-aligned **MSC2**…supply chain partner input was used in developing manufacturing plans and solutions **MSC3**…our supply chain plans/solutions were manufacturing-aligned **MSC4**…manufacturing input was used in developing our supply chain partners' plans and solutions **To what extent would you agree that** **MSC5**…our supply chain partners understood our manufacturing capabilities related to the product development **MSC6**…our manufacturing personnel understood the capabilities of our supply chain partners	Bendoly et al. (2012)
Controls (External ideas)	To what extent does your firm capture ideas and technologies that are generated externally through licensing and patents **DV3-**Was the product licensed **DV4-**Was the product patented	Fisher (2014)
Product Innovation Performance (PIP)	**Our latest innovative product** **PIP1**…release was successful in achieving the sales target **PIP2**…release was successful in achieving market share target **PIP3**…release was successful in achieving competitive advantage target **PIP4**…release was successful in achieving customer satisfaction target **PIP5**…addresses a wholly new customer benefit. **PIP6**…requires strong attitude and behavior changes of customers. **PIP7**…offers customers unique advantages over competitor products. **PIP8**…requires strong learning effort on the part of customers. **PIP9**…introduces completely new features to the market. **PIP10**…what percentage of your firm's revenue originated from this product?	Bendoly et al. (2012) and (Talke & Colarelli O'Connor, 2011)

Table 4.
Sample descriptive and Partial Correlations

		Mean	Std. Dev.	1	2	3	4	5	6	7	8	9	10
1	Product Innovation Performance	3.6395	1.9902	1									
2	Market Intelligence Quality	2.8773	0.6772	0.2457	1								
3	Manufacturing-marketing coordination	2.9641	0.7789	0.2742	0.3364	1							
4	Supply-chain intelligence quality	2.5854	0.6237	0.1931	0.1837	0.1898	1						
5	Manufacturing Supply Chain coordination	2.8345	0.8083	0.2232	0.1522	0.6118	0.349	1					
6	Whether the product was licensed	1.9768	0.8008	-0.094	0.0191	-0.0237	0.0451	0.0292	1				
7	Whether the product was patented	2.0823	0.9508	-0.0867	0.0922	-0.1218	0.1088	-0.0246	0.6077	1			
8	Employees	157.1620	375.1426	-0.0111	0.0477	-0.0032	0.0526	-0.016	0.1612	-0.0141	1		
9	Assets	559980.1000	2938173.0000	-0.0191	0.0548	0.0102	0.0864	-0.0191	0.073	0.0168	0.6224	1	
10	Sales Growth	0.0846	0.9500	0.0406	-0.036	0.1046	0.1541	0.0632	-0.0184	-0.0417	0.0238	0.02	1
11	ROA	10.1379	14.2046	0.049	0.055	-0.0168	0.0038	-0.0542	0.1044	0.0029	-0.0066	-0.0265	-0.2594

Notes.
All correlations at or above |0.15| are significant at $p < 0.05$ or below (two-tailed)

Table 5.
Results of Ordinary Least Squares (OLS) regression.

VARIABLES	(1) Product Innovation Performance	(2) Product Innovation Performance	(3) Product Innovation Performance	(4) Product Innovation Performance	(5) Product Innovation Performance
Market Intelligence Quality		0.500*	-2.302***		-1.976**
		(0.256)	(0.856)		(0.877)
Manufacturing-marketing coordination		0.363	-2.302***		-1.894**
		(0.276)	(0.847)		(0.865)
Supply-chain intelligence quality		0.382		-2.418**	-1.450
		(0.286)		(1.044)	(1.047)
Manufacturing Supply Chain coordination		0.178		-1.935**	-1.453
		(0.267)		(0.863)	(0.880)
Market Intelligence Quality × Manufacturing-marketing coordination [H1]			0.920***		0.768***
			(0.267)		(0.277)
Supply-chain intelligence quality × Manufacturing Supply Chain coordination [H2]				0.929***	0.589*
				(0.326)	(0.332)
Whether the product was licensed	-0.200	-0.194	-0.245	-0.213	-0.229
	(0.275)	(0.263)	(0.254)	(0.262)	(0.253)
Whether the product was patented	-0.0755	-0.100	-0.0174	-0.0409	-0.0180
	(0.225)	(0.221)	(0.212)	(0.217)	(0.214)
Employees	5.74e-05	5.34e-05	5.32e-05	-0.000226	-0.000132
	(0.000496)	(0.000473)	(0.000457)	(0.000482)	(0.000465)
Assets	-1.13e-08	-2.20e-08	-9.53e-09	7.43e-09	5.50e-10
	(6.11e-08)	(5.83e-08)	(5.63e-08)	(5.87e-08)	(5.66e-08)
Sales Growth	0.101	0.0384	0.129	0.0189	0.0701
	(0.156)	(0.152)	(0.145)	(0.150)	(0.147)
ROA	0.00978	0.00796	0.00436	0.0112	0.00551
	(0.0119)	(0.0114)	(0.0111)	(0.0114)	(0.0111)
Constant	4.091***	0.159	9.548***	8.849***	12.17***
	(0.476)	(1.026)	(2.624)	(2.636)	(3.440)
Observations	148	148	148	148	148
R-squared	0.017	0.135	0.186	0.134	0.215
F	0.396	2.143	3.498	2.374	3.080

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 1. Theoretical model

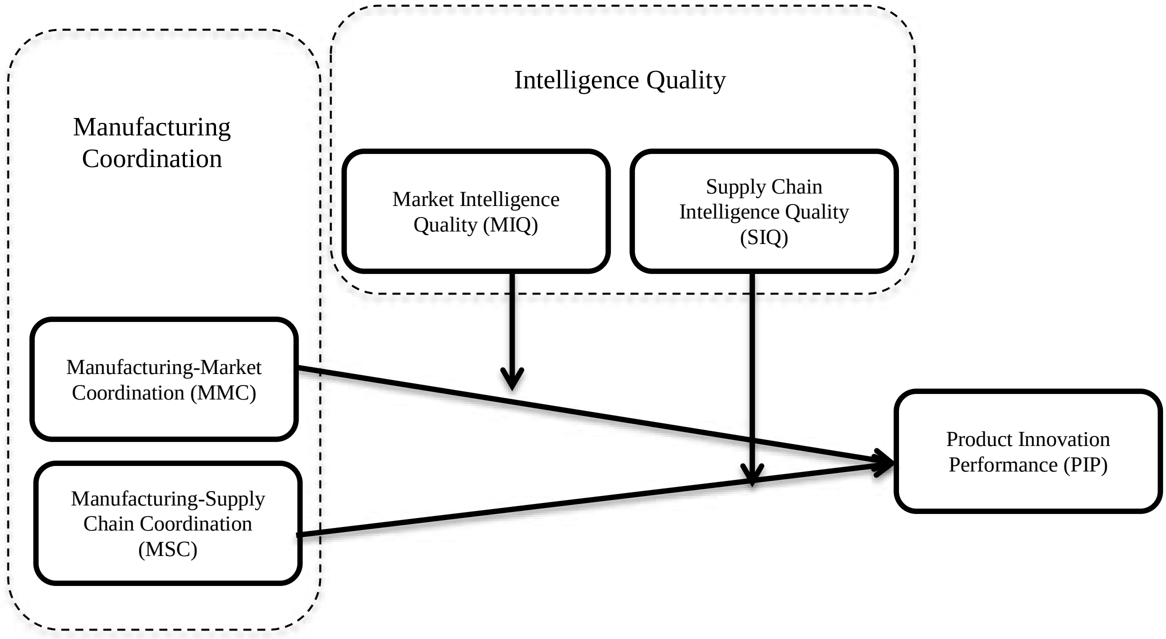

Figure 2. Moderation plots

Figure 2a. The moderating effect of Marketing Intelligence Quality on the relationship between Marketing-Manufacturing Coordination and Product Innovation Performance

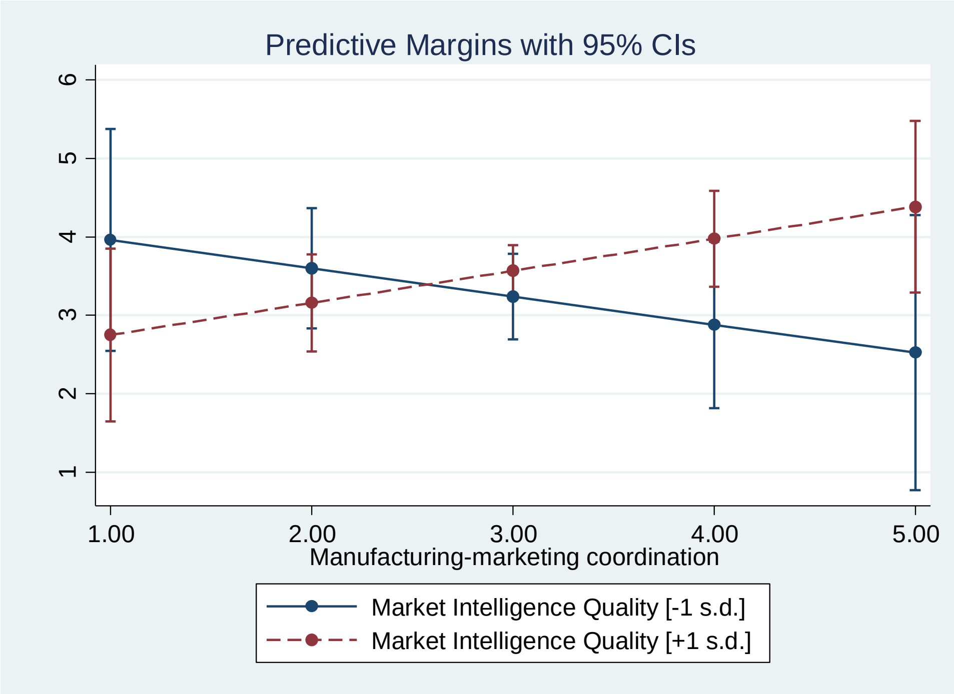

Figure 2b. Moderating effect of Supply Chain Intelligence Quality on the relationship between Manufacturing-Supply Chain Coordination and Product Innovation Performance