

The Impact of Knowledge Management Orientation on New Product Commercialization: The Mediating Role of Market Orientation

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How to cite this paper: Ghahroudi, M.R., Hoshino, Y. and Ahmadpoury, F. (2019) The Impact of Knowledge Management Orientation on New Product Commercialization: The Mediating Role of Market Orientation. *American Journal of Industrial and Business Management*, 9, 1949-1968.
<https://doi.org/10.4236/ajibm.2019.910127>

Received: September 3, 2019

Accepted: October 28, 2019

Published: October 31, 2019

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Abstract

The knowledge management orientations that firms adopt as a business input may lead at least partially to the superior performance of the new products they introduce to the market. Our empirical research investigates the knowledge management orientation effect on new product commercialization performance, using data collected from 700 Iranian manufacturing firms in six industries including plastic, steel manufacturing, construction, machinery, stone, mine, and Nano industries. However, our final sample due to missing data is 252 firms. Further, we study the mediating role of proactive and responsive market orientation. Our findings indicate that knowledge management orientation is positively associated with three aspects of new product commercialization, namely product advantage, new product development, and the number of new products introduced to the market. However, there was no significant mediating role in market orientation. Finally, our results show that market orientation and knowledge management orientation affect commercialization performance and therefore could improve new product commercialization.

Keywords

Knowledge Management Orientation, Proactive, Responsive, Market Orientation, New Product Commercialization

1. Introduction

Continuous environmental changes such as changing customer tastes and market needs threaten the survival of organizations in different ways. Under such

conditions, market success and sustainable competitive advantage depend on appropriate market predictions and new product development that meets customer needs. Thus, the successful introduction of new products to the market (*i.e.*, commercialization) is crucial for the corporations.

Iran ranked as the 89th most competitive nation in the world in the year 2018 based on the Global Competitiveness Report published by the World Economic Forum. As of 2014, 81,000 small industrial enterprises employed more than 1 million workers in Iran. Small industries constitute 92 percent of Iranian industries, 45 percent of the country's industrial employment, and 17 percent of the country's production. However, because of its weakness or absence, the support industry makes little contribution to the innovation/technology development activities. In 2016, Iran had nearly 3000 knowledge-based firms accounting for 70,000 jobs and \$6.6 billion in revenue (UNCTAD, 2016) [1].

Technology described as the engine of progress, wealth generation, and economic growth (Allen, 2012; Dorff & Worthington, 1987) [2] [3]. Although technology alone does not generate wealth, its emergence, in the form of products and services, generates wealth through the commercialization of technological inventions and innovations (Frishammar *et al.*, 2012; Heslop *et al.*, 2001) [4] [5].

Dynamic capability theory suggests that: 1) firms vary in their ability to control, access, and organize productive resources, suggesting that the capacity of a firm to purposefully create, extend, and modify its resource base determines firm performance (Helfat *et al.*, 2007) [6]; 2) differences in resources and firm abilities at least partially explain performance variations among close competitors (Eisenhardt & Martin, 2000) [7]; and 3) firms need to have capabilities that not only allow them to exploit internal resources but also permit them to access, configure, and leverage external network resources embedded in business partners (e.g., Teece, 2007) [8].

The market-oriented approach refers to the ability of a firm to compete by predicting market requirements and creating long-term relations with customers and suppliers (Schindehutte *et al.*, 2008) [9]. Acquiring knowledge on customers and competitors and sharing these data among the functional areas in a firm are key dimensions of market orientation (Kohli & Jaworski, 1990; Narver & Slater, 1990) [10] [11]. The ability to integrate knowledge and use it to create new knowledge in organizations is an important factor in commercialization (Frishammar *et al.*, 2012) [4].

The commercialization of innovations requires suitable and effective support that can improve performance. Organizational support or perceived organizational support explains how an organization encourages its human resources to meet its goals (Colakoglu *et al.*, 2010) [12]. From this point of view, organizational support that influences commercialization performance, includes IT technology (Cho & Lee, 2013; Durmuşoğlu & Barczak, 2011; Protogerou *et al.*, 2011) [13] [14] [15], top management support (Harmancioglu, 2010; Martín-Rojas, 2013) [16] [17], and the organization's capabilities such as marketing (Kim *et al.*, 2011;

Wilden *et al.*, 2013) [18] [19], R&D (Kim *et al.*, 2011) [18], NPD (Lew & Sinkovics, 2013) [20], and creativity (Kock *et al.*, 2011) [21].

The knowledge factors (e.g., market knowledge, knowledge integration and exploitation, explicit and implicit knowledge) are also effective for accelerating the commercialization (Heng, 2012) [22]. Knowledge management can enable companies to improve their commercialization performance (Chiang & Shih, 2011; Frishammar *et al.*, 2012) [4] [23]. Further, the literature suggests that knowledge is critical to the performance of NPD (Chiang & Shih, 2011) [23] and leads to improvements in product innovation performance (Kostopoulos *et al.*, 2011) [24]. However, few studies have investigated the effect of knowledge orientation on commercialization.

Moreover, although marketing and strategic management researchers have shown that the relationship between market orientation and knowledge management affects corporate performance, the effectiveness of such variables on commercialization in Iranian corporations has been neglected. The current research examines the effects of these variables on new product commercialization.

2. Literature Review

2.1. New Product Commercialization

The commercialization of innovations requires proper and effective support to be able to improve performance. The organizational support or perceived organizational support points to how a corporation encourages its workforces to meet the goals of the organization (Colakoglu *et al.*, 2010) [12]. Furthermore, the organizational support influencing commercialization performance, are technology (Cho & Lee, 2013) [13]; the patent system (Datta *et al.*, 2011) [25]; Organizational capabilities such as marketing and production (Kim *et al.*, 2011) [18]; R & D, and learning or education (Kim *et al.*, 2011; Park & Ryu, 2015) [18] [26]; rewards (Lam, 2011) [27]; and organizational creativity (Kock *et al.*, 2011; Wu, 2010) [21] [28].

Moreover, the knowledge factor is effective in accelerating commercialization (Heng *et al.*, 2012) [22]. While many researchers studied commercialization of knowledge and related literature, however, few studies have examined the effect of knowledge on the commercialization of technology and products.

The strategic orientations of a firm, including market orientation, technology orientation (Mu & Di Benedetto, 2011) [29], entrepreneurial orientation (Mu & Di Benedetto, 2011; Li *et al.*, 2008) [29] [30] and network orientation (Mu & Di Benedetto, 2011; Park & Rhee, 2013) [29] [31] plays a vital role in the commercialization of novel innovations.

Zahra and Nielsen (2002) [32] examined the impact of using internal and external sources on the successful commercialization of technology. They employed four scales in their study to measure the commercialization of technology including: 1) the number of new products; 2) the number of new fundamental

products; 3) the number of patents; and 4) the speed of commercialization of technology. Further, Park and Rhee (2013) [31] investigated the mediating role of technology commercialization between the types of network and business performance. The commercialization of technology in their study reflects the extent to which an enterprise effectively utilizes patents and know-how to introduce products to the market, through modifying the three items used by Zahra and Nielsen (2002) [32] and Li *et al.* (2008) [30]. The scales consist of: 1) our company effectively uses all its patents and know-how; and 2) our company quickly developed a large number of products and introduces to the market; and 3) new products developed by our company have a brighter future market.

Park and Ryu (2015) [26] conducted a study to examine the impact of R&D capability and learn the capabilities of SMEs entrepreneurs on technology commercialization. In their study, the commercialization of technology refers to the extent to which the firm is capable of transferring patents and know-how to products (Zahra and Nielsen, 2002) [32]. Moreover, Mu and Di Benedetto (2011) [29] studied the effect of strategic orientation (market orientation, technology orientation, entrepreneurial orientation, and network orientation) on the commercialization of a new product. They have used three indicators to measure the performance of new product commercialization: the new product novelty (adapted by Luca and Atuahene-Gima, 2007) [33], the New product advantage (adapted from Song and Parry, 1997; Gatignon and Xuereb, 1997) [34] [35] and the number of new products introduced into the market.

Narver *et al.* (2004) [11] stated that market orientation consists of two essential behavioral dimensions, including proactive market orientation and responsive market orientation. The proactive market orientation is an attempt to understand and meet the latent needs of customers, while responsive market orientation is an attempt to understand and meet the customer's expressed needs. The expressed needs may include latent and expressed solutions. Here, the needs and solutions expressed by customers defined as needs and solutions that customers are aware of and can therefore express.

2.2. Knowledge Management Orientation

Many managers consider knowledge management to be a process that enables organizations to use knowledge assets for creating value (Goh, 2004) [36], leading to the improvement of business performance (Narver & Slater, 1990) [37]. Knowledge management focuses on important knowledge throughout the organization (Sabherwal & Becerra-Fernandez, 2003) [38]. Leonard (1998) [39] showed that companies with larger knowledge production and management capacity have a higher innovation capacity.

A firm that uses more knowledge management behaviors and methods are likely to have a knowledge management orientation (Darroch & McNaughton, 2003) [40]. A strong knowledge management orientation provides the basis of knowledge, enabling the firm to effectively interpret data on external producers

and events (Wang *et al.*, 2009) [41]. Lin *et al.* (2015) [42] showed that functional cooperation through knowledge creation provides new opportunities for technology commercialization. Frishammar *et al.* (2012) [4] studied manufacturing companies in Sweden and showed that knowledge integration that resulted from the usual activities of product commercialization and development allowed them to adapt their technologies to the market (*i.e.*, these activities were critical factors of technology commercialization). Thus:

Hypothesis 1: Knowledge management orientation has a positive effect on product commercialization.

2.3. Market Orientation

Market orientation embodies the classic marketing principle that firms need to stay close to their customers. It emphasizes the need for the entire organization to generate, disseminate, and respond to information related to customer needs/preferences and the competition (Mu & Di Benedetto, 2011) [29]. More specifically, it is defined as “the degree to which the business unit obtains and uses information from customers, develops a strategy which will meet customer needs, and implements that strategy by being responsive to customers’ needs and wants” (Ruekert, 1992, p. 228) [43]. The NPD process under a market orientation is an outside-in process that focuses on meeting customer needs and delivering superior value (Mu, 2015) [44].

While there are different interpretations of market orientation (Day, 1994; Kohli & Jaworski, 1990; Narver & Slater, 1990) [10] [37] [45], they all focus on the market data, activities related to customers and competitors, and coordination between units, especially knowledge acquisition, knowledge sharing, and behavioral accountability. The successful commercialization of new products necessitates products that meet the market needs effectively. Products introduced by companies with a market orientation are more likely to bring about customer satisfaction than competitors’ products (Ketchen *et al.*, 2007; Paladino, 2007) [46] [47]. Thus, market orientation increases new product commercialization by considering customer needs continuously with an emphasis on the effective use of market data (Atuahene-Gima *et al.*, 2005; Han *et al.*, 1998; Langerak *et al.*, 2004) [48] [49] [50].

Further, market orientation has a positive effect on firm performance, perhaps by acting as a stimulus for satisfying customer needs (Langerak, 2003; Li *et al.*, 2008; Schindehutte *et al.*, 2008) [9] [30] [50]. Hammond *et al.* (2006) [51] stated that a high level of market orientation leads to the higher ability of organizations to achieve their goals. Thus, a firm needs market orientation more than other strategic orientations to achieve success. Zahra (2008) [52] found a positive relationship between market orientation and firm performance, although entrepreneurial behavior may be needed in industries with more complicated technologies. Voss and Voss (2000) [53] indicated that the dependency between market orientation and performance differs based on the type of performance. Paladino

(2007) [47] proved that those looking for high financial performance and customer value must focus on market orientation development. Yang *et al.* (2012) [54] studied whether market orientation and technology orientation affect innovation performance by different degrees. Muand Di Benedetto (2011) [29] used the Narver and Slater (1990) [37] measure to prove that market orientation has a supportive effect on new product commercialization. Atuahene-Gima *et al.* (2005) [48] showed the effect of responsive and proactive market orientations on NPD performance. Thus:

Hypothesis 2: A proactive market orientation has a positive effect on product commercialization.

Hypothesis 3: A responsive market orientation has a positive effect on product commercialization.

2.4. The Mediating Role of Market Orientation

The knowledge management orientation of a firm affects the value of market orientation efforts (Day, 1994) [45]. A lack of knowledge management orientation weakens the effectiveness of production, release of external information into the market, and use of information to respond to the market. On the contrary, organizations must have a supportive culture of knowledge sharing to implement knowledge management activities successfully (Park & Kim, 2005) [55]. The culture must be considered at the time of introducing new knowledge activities because this affects the acceptance of such activities in organizations (Lai & Lee, 2007). Market orientation reflects a culture with organizational learning behaviors that aim to create and maintain profitable relations with customers (Olavarrieta & Friedmann, 2008) [56]. Hence, a positive relationship between a market-oriented culture and the knowledge resources of an organization exists (Day, 1994) [45].

Ferraresi *et al.* (2012) [57] studied data on 241 Brazilian companies and showed a positive relationship between effective knowledge management and market orientation. Although no direct effect of knowledge management on creativity and performance was found, a positive effect was shown when market orientation was used as a mediator in such relations. Wang *et al.* (2009) [41] studied the relationships among knowledge management orientation, market orientation, and firm performance. The components of organizational memory, knowledge sharing, knowledge absorption, and knowledge acceptance used to measure knowledge management orientation had a positive effect on three components of market orientation, namely production, transfer, and responding to information. In addition, Wang *et al.* (2009) [41] showed the positive effect of market orientation on performance and the mediating role of market orientation in the relationship between knowledge management orientation and performance. Darroch and McNaughton (2003) [40] studied 443 companies in the production and service industries and raised knowledge management orientation as a distinguishable ability supporting the creation of sustainable competitive advantage

such as innovation. Thus, their findings show that firms with a knowledge management orientation outperform market-oriented firms. Thus:

Hypothesis 4: Knowledge management orientation has a positive effect on product commercialization through a proactive market orientation.

Hypothesis 5: Knowledge management orientation has a positive effect on product commercialization through a responsive market orientation.

While strategic orientation can be an important predictor for NPD, taking a strategic orientation alone is insufficient and a better understanding of the probabilities is necessary. Nonetheless, market orientation and entrepreneurial orientation have a positive relation with NPD (Mu *et al.*, 2017) [58]. Several studies have been conducted on commercialization in Iran such as the commercialization of inventions (Zare & Mirjalili, 2013; Migonouri & Ahmadi, 2012) [59] [60]. Based on the literature review and research background, **Figure 1** presents the conceptual framework and model used in this study.

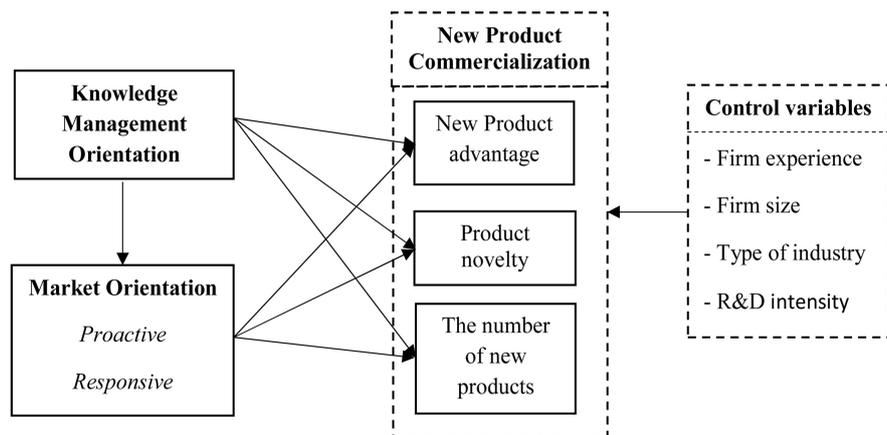


Figure 1. Conceptual model.

3. Research Methodology

The population of this study included active manufacturing companies in different industries in Iran. The number of such companies was about 88,110 based on the Behinyab website. The questionnaire was designed based on literatures (**Table 1**) and sent to managers of 700 firms in various industries including plastic, steel manufacturing, construction, machines and equipment, stone industries, mine, and Nano industries. Of these, 298 companies responded. Finally, due to missing data, our final samples were 252 manufacturing firms in Iran (response rate: 36%). All measures for variables have been derived from previous studies and evaluated on a six-point Likert scale (**Table 1**).

Product commercialization: This variable is based on the new product commercialization indicators used by Mu and Di Benedetto (2011) [29] in which is included the number of new products introduced to the market during the past five years as well as their novelty and competitive advantages (Darroch & McNaughton, 2003) [40].

Knowledge management orientation: Knowledge management is the process of creating, releasing, and using the knowledge inside and among organizations (Darroch & McNaughton, 2003) [40]. Following Darroch and McNaughton (2003) [40], we considered three dimensions of knowledge management orientation: knowledge acquisition, knowledge sharing, and knowledge accountability.

Market orientation: This refers to the relation between the firm's business strategy and the hidden and expressed needs of target customers (Slater & Narver, 1998) [61]. Following Narver *et al.* (2004) [11], the two dimensions of proactive and responsive market orientations were used to measure the market.

In addition, four variables were used as control variables:

1) The experience of a firm affects its ability to learn and mobilize resources. Older companies may have more experience in introducing new products to the market (Mu & Di Benedetto, 2011) [29]. The experience of a firm was measured by the number of years a company had participated in the business.

2) Firm size also has a considerable effect on the decisions of companies because it is related to their abilities to exploit current competencies, produce new products, and promote innovations (Chandy & Tellis, 2000; Mu *et al.*, 2017) [58] [62]. Large companies may allocate more resources to customer relationship management, marketing studies, and R&D. The number of employees was used to measure firm size.

3) The R&D intensity in a company is a large driving force behind product commercialization (Day, 1994; Kleinschmidt *et al.*, 2007) [45] [63]. Thus, its effect was controlled for through the budget of R&D activities to total sales.

4) The type of industry can affect the technological opportunities of companies and thus the number of new products introduced to the market. It can also affect product profitability, the success rate of new product commercialization, customer satisfaction with new products, and the commercialization speed of new products (Gatignon & Xuereb, 1997; Song & Parry, 1997) [35] [34]. Furthermore, the sample distribution based on industry type is shown in **Figure 2**. It is noteworthy that the largest number responded samples are active in the plastic industry and we have the least number in mines.

Table 1. Measures for variables.

Ref.		Measure	Variable
Darroch & McNaughton (2003)	6 items	Knowledge acquisition	Knowledge management orientation
	5 items	Knowledge dissemination	
	6 items	Knowledge accountability	
Narver <i>et al.</i> (2004)	8 items	Proactive	Market orientation
	7 items	Responsive	
Mu & Di Benedetto (2011)	1 items	Number of new products	New product commercialization performance
	5 items	Product novelty	
	6 items	New product advantage	

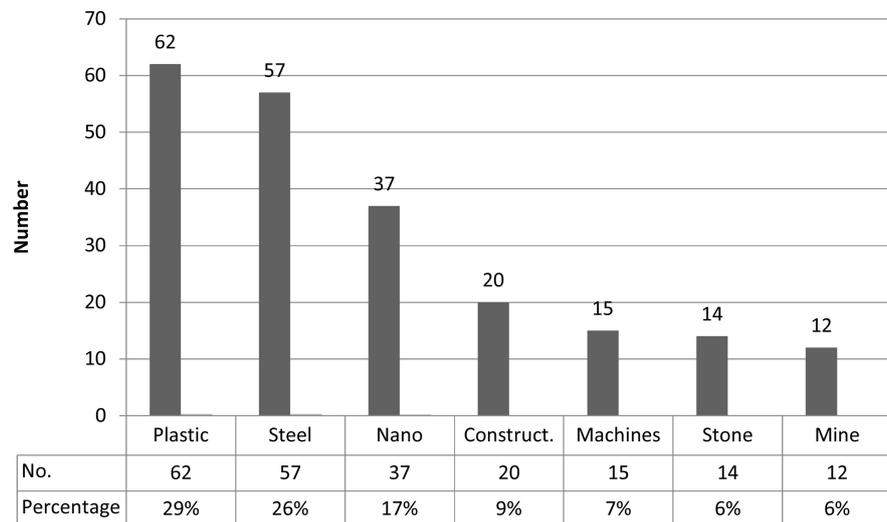


Figure 2. Data sample distribution based on the type of industry.

4. Data Analysis and Research Findings

The validity of the measurement tool used in this study was studied in terms of face validity, content validity, and structural validity. To study the simple validity of the variables, a model was designed for each variable. The values of the factor loadings and AVE were more than 0.5 and the CR value was more than 0.7. The goodness-of-fit indicators of each model are as follows: product commercialization χ^2 ($n = 252$, $df = 19$) = 46.24, $P = 0.000$, RMSEA = 0.075; knowledge management orientation χ^2 ($n = 252$, $df = 24$) = 70.34, $P = 0.000$, RMSEA = 0.088; and market orientation χ^2 ($n = 252$, $df = 19$) = 28.75, $P = 0.069$, RMSEA = 0.045.

Table 2 presents the correlation analysis. Comparing the average dimensions of knowledge management orientation and market orientation showed that the studied companies were mostly market-oriented than knowledge management-oriented. Furthermore, the lower average of proactive market orientation ($\mu = 4.41$) than responsive market orientation ($\mu = 4.44$) indicated that the sample companies responded to the expressed needs of customers more than their hidden needs. Comparing the average variables related to the knowledge management process showed that knowledge sharing ($\mu = 3.90$) among these companies was relatively low. Comparing the correlation among the variables showed that the dimensions of knowledge management orientation (knowledge acquisition, sharing, and accountability) had a high positive correlation. This was also true for the dimensions of market orientation.

Table 3 shows the results of testing Hypothesis 1. The relationships between the independent variable of knowledge management orientation and dependent variables of product advantage, product novelty, and the number of new products were tested in two models. Model 1 shows the results for the state including only the control variables. By neutralizing the effect of such variables in model 2, it was observed that when knowledge management orientation was added into

Table 2. Descriptive statistics and correlations.

	Variables	Mean	Standard deviation	1	2	3	4	5	6	7	8	9	10	11
1	Product advantage	4.89	0.83	1										
2	Product novelty	4.04	1.07	0.252**	1									
3	No. of new products	2.08	1.32	-0.004	0.114	1								
4	Knowledge acquisition	4.20	1.06	0.340**	0.280**	0.148*	1							
5	Knowledge dissemination	3.90	1.11	0.330**	0.309**	0.140*	0.616**	1						
6	Knowledge accountability	4.13	1.09	0.403**	0.357**	0.141*	0.595**	0.599**	1					
7	Proactive market orientation	4.41	0.98	0.357**	0.181**	0.212**	0.543**	0.467**	0.582**	1				
8	Responsive market orientation	4.44	0.94	0.438**	0.219**	0.167*	0.620**	0.510**	0.588**	0.710**	1			
9	Firm experience	2.33	0.85	-0.007	-0.077	0.106	0.150*	0.132*	0.053	0.122	0.131*	1		
10	Firm size	3.4	1.26	0.027	-0.057	0.237**	0.108	0.050	0.039	0.114	0.102	0.569**	1	
11	R&D expenses	2.82	0.91	0.140*	0.192**	0.064	0.219**	0.291**	0.354**	0.258**	0.241**	0.006	-0.042	1

**P < 0.01, *P < 0.05.

the equations, almost 16% of the variance was explained by the relationship between knowledge management orientation and product advantage (change in the coefficient of determination = 0.159, $P < 0.01$) and almost 9% of the variance was explained by the relationship between knowledge management orientation and product novelty (change in the coefficient of determination = 0.879, $P < 0.01$). Based on the predictions, the regression results show that knowledge management orientation had a significant relationship with product advantage ($P < 0.01$, $t = 6.350$) and product novelty ($P < 0.01$, $t = 4.575$). Thus, Hypotheses 1 was supported. However, the significance level of the relationship between knowledge management orientation and the number of new products in model 2 was not sufficiently small ($F = 1.784$, $Sig = 0.066$).

Table 4 shows the results of testing Hypothesis 2. The proactive market orientation justified almost 11% of the dispersion in product advantage (change in the coefficient of determination = 0.114, $P < 0.01$), 2% of product novelty (change in the coefficient of determination = 0.020, $P < 0.01$), and almost 2% of the new product dispersion (change in the coefficient of determination = 0.024, $P < 0.05$). The results indicated that the proactive market orientation had a significant relationship with product advantage ($P < 0.01$, $t = 5.246$), product novelty ($P < 0.05$, $t = 2.112$), and the number of new products ($P < 0.05$, $t = 2.250$).

Table 3. Hierarchical regressions (knowledge management orientation).

Variable	Product Advantage				Product Novelty				No. of New Products				VIF
	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		
	β	t	β	t	β	t	β	t	β	t	β	t	
Firm experience	-0.033	-0.421	-0.071	-0.992	-0.091	-1.192	-0.119	-1.630	-0.045	-0.573	-0.059	-0.748	1.278
No. of employees	-0.060	-0.785	-0.083	-1.184	0.105	1.391	0.088	1.221	0.145*	1.864	0.138*	1.772	1.244
R&D expenses	0.143*	1.965	0.012	0.178	0.194***	2.709	0.098	1.363	0.093	1.254	0.056	0.726	1.128
Steel manufacturing	-0.093	-1.125	-0.090	-1.181	-0.005	-0.059	-0.002	-0.027	-0.070	-0.818	-0.071	-0.839	1.460
Construction industries	-0.087	-1.145	-0.069	-0.983	-0.033	-0.446	-0.020	-0.274	0.060	0.765	0.060	0.770	1.231
Machines and equipment	-0.157**	-2.116	-0.120*	-1.752	0.025	0.344	0.053	0.757	-0.120	-1.555	-0.109	-1.418	1.174
Stone industries	-0.140*	-1.907	-0.099	-1.467	0.008	0.112	0.038	0.555	0.000	-0.004	0.012	0.152	1.146
Mine industries	-0.034	-0.466	-0.031	-0.464	0.113	1.572	0.115*	1.681	0.139*	1.860	0.143*	1.916	1.127
Nano industries	-0.094	-1.113	-0.099	-1.280	0.109	1.312	0.105	1.329	0.099	-1.150	-0.101	-1.181	1.517
Knowledge management orientation			0.428***	6.350			0.317***	4.574			0.119	1.573	
R	0.231		0.461		0.288		0.412		0.274		0.295		
R Square	0.053		0.212		0.083		0.170		0.075		0.087		
R Square change	0.053		0.159		0.083		0.087		0.075		0.012		
Adjusted R Square	0.011		0.173		0.042		0.128		0.031		0.038		
F statistics	1.260		5.387		2.021		4.091		1.694		1.784		
Sig.	0.261		0.000		0.039		0.000		0.093		0.066		

n = 252, *P < 0.1, **P < 0.05, ***P < 0.01.

Thus, Hypotheses 2 was supported.

Table 5 presents the results of testing Hypothesis 3, showing that almost 20% of the product advantage dispersion (change in the coefficient of determination = 0.197, P < 0.01), 3.5% of the product novelty dispersion (change in the coefficient of determination = 0.035, P < 0.01), and 2% of the dispersion in the number of new products (change in the coefficient of determination = 0.020, P < 0.01) were related to the responsive market orientation. As shown, the responsive market orientation had a significant relation with product advantage (P < 0.01, t = 7.245), product novelty (P < 0.01, t = 2.813), and the number of new products (P < 0.01, t = 2.023). Thus, Hypothesis 3 were supported.

Figure 3 presents the results related to testing Hypotheses 4 and 5. The shapes in rows 1 and 2 relate to Hypothesis 4. As can be seen, when studying the effect of knowledge management orientation on product advantage and product novelty through the proactive market orientation, no effect of the proactive market orientation on product advantage (t = 0.93 < 1.96) or product novelty (t = -1.54 > -1.96) was found. Thus, the proactive market orientation does not have

Table 4. Hierarchical regressions (proactive market orientation).

Variable	Product Advantage				Product Novelty				No. of New Products				VIF	
	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 1	Model 2
	β	t	β	t	β	t	β	t	β	t	β	t		
Firm experience	-0.033	-0.421	-0.066	-0.906	-0.091	-1.192	-0.105	-1.383	-0.045	-0.573	-0.066	-0.837	1.278	1.288
No. of employees	-0.060	-0.785	-0.069	-0.959	0.107	1.391	0.101	1.353	0.145*	1.864	0.140*	1.813	1.244	1.245
R&D expenses	0.143*	1.965	0.056	0.794	0.194***	2.709	0.158**	2.157	0.093	1.254	0.053	0.707	1.128	1.194
Steel manufacturing	-0.093	-1.125	-0.115	-1.478	-0.005	-0.059	-0.014	-0.173	-0.070	-0.818	-0.059	-0.702	1.460	1.464
Construction industries	-0.087	-1.145	-0.074	-1.032	-0.033	-0.446	-0.028	-0.375	0.060	0.765	0.076	0.972	1.231	1.232
Machines & equipment	-0.157**	-2.116	-0.140**	-2.005	0.025	0.344	0.032	0.444	-0.120	-1.555	-0.104	-1.363	1.174	1.177
Stone industries	-0.140*	-1.907	-0.130*	-1.886	0.008	0.112	0.012	0.170	0.000	-0.004	0.012	0.155	1.146	1.146
Mine industries	-0.034	-0.466	-0.054	-0.782	0.113	1.572	0.105	1.468	0.139*	1.860	0.137*	1.846	1.127	1.131
Nano industries	-0.094	-1.113	-0.088	-1.107	0.109	1.312	0.112	1.354	-0.099	-1.150	-0.085	-1.000	1.517	1.517
Proactive market orientation			0.354***	5.246			0.148**	2.112			0.164**	2.250		1.094
R	0.231		0.410		0.288		0.321		0.274		0.315			
R Square	0.053		0.168		0.083		0.103		0.075		0.099			
R Square change	0.053		0.114		0.083		0.020		0.075		0.024			
Adjusted R Square	0.011		0.126		0.042		0.058		0.031		0.051			
F statistics	1.260		4.036		2.021		2.297		1.694		2.064			
Sig.	0.261		0.000		0.039		0.014		0.093		0.029			

n = 252, *P < 0.1, **P < 0.05, ***P < 0.01.

a mediating role in the relationships between knowledge management orientation and product advantage or between knowledge management orientation and product novelty. Thus, Hypotheses 4 was rejected.

Row 3 of **Figure 3** shows that when studying the effect of knowledge management orientation on product advantage through the responsive market orientation, no effect of knowledge management orientation on product advantage ($t = 0.71 < 1.96$) was found. On the contrary, the relationships between knowledge management orientation and responsive market orientation and between responsive market orientation and product advantages were not confirmed. Thus, Hypothesis 5 was supported. In row 4 of the same figure, the relationship between knowledge management orientation and product novelty was studied through the responsive market orientation. As can be seen, the effect of responsive market orientation on product novelty ($t = -1.40 > -1.96$) was not supported. Thus, the responsive market orientation does not have a mediating role in the relationship between knowledge management orientation and product novelty.

Table 5. Hierarchical regressions (responsive market orientation).

Variable	Product Advantage				Product Novelty				No. of New Products				VIF	
	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 1	Model 2
	β	t	β	t	β	t	β	t	β	t	β	t		
Firm experience	-0.033	-0.421	-0.101	-1.442	-0.091	-1.192	-0.120	-1.580	-0.045	-0.573	-0.071	-0.898	1.278	1.302
No. of employees	-0.060	-0.785	-0.070	-1.021	0.105	1.391	0.101	1.360	0.145*	1.864	0.140*	1.818	1.244	1.244
R&D expenses	0.143*	1.965	0.037	0.551	0.194***	2.709	0.149**	2.067	0.093	1.254	0.056	0.739	1.128	1.186
Steel manufacturing	-0.093	-1.125	-0.064	-0.862	-0.005	-0.059	0.008	0.094	-0.070	-0.818	-0.082	-0.969	1.460	1.464
Construction industries	-0.087	-1.145	-0.069	-1.012	-0.033	-0.446	-0.026	-0.348	0.060	0.765	0.058	0.751	1.231	1.232
Machines and equipment	-0.157**	-2.116	-0.125*	-1.881	0.025	0.344	0.039	0.537	-0.120	-1.555	-0.116	-1.525	1.174	1.179
Stone industries	-0.140*	-1.907	-0.101	-1.537	0.008	0.112	0.025	0.344	0.000	-0.004	0.006	0.078	1.146	1.153
Mine industries	-0.034	-0.466	-0.045	-0.693	0.113	1.572	0.108	1.532	0.139*	1.860	0.131*	1.765	1.127	1.128
Nano industries	-0.094	-1.113	-0.067	-0.891	0.109	1.312	0.120	1.470	-0.099	-1.150	-0.100	-1.174	1.517	1.520
Responsive market orientation			0.465***	7.245			0.196***	2.813			0.149**	2.023		1.097
R	0.231		0.500		0.288		0.343		0.274		0.308			
R Square	0.053		0.250		0.083		0.118		0.075		0.095			
R Square change	0.053		0.197		0.083		0.035		0.075		0.020			
Adjusted R Square	0.011		0.213		0.042		0.074		0.031		0.046			
F statistics	1.260		6.673		2.021		2.673		1.694		1.959			
Sig.	0.261		0.000		0.039		0.004		0.093		0.040			

n = 252, *P < 0.1, **P < 0.05, ***P < 0.01.

5. Discussion and Conclusions

We studied product commercialization in three aspects: product advantage, product commercialization, and the number of new products introduced to the market. The findings showed that knowledge management orientation affects the advantage and freshness of products. In addition, the responsive and proactive market orientations affect all the dimensions of commercialization. In other words, these two factors cause the presentation of products that are fresh for both the firm and the industry, add new customers, and satisfy the needs not already identified. Products that have higher quality than competitors' products attract more customer satisfaction. In a knowledge-based management firm, a strong basis of knowledge enables the company to process and interpret the data on external events and procedures (Wang *et al.*, 2009) [41]. A knowledge-based management firm releases market data on the whole organization and responds to it. Such a firm is also flexible and opportunistic, and it has strong marketing programs for changing products, processes, and strategies (Darroch & McNaughton, 2003) [40]. On the contrary, the business strategy of a market-oriented firm is sufficiently related to the expressed and hidden needs of target customers (Slater & Narver, 1998) [61]. By providing products that meet customer needs

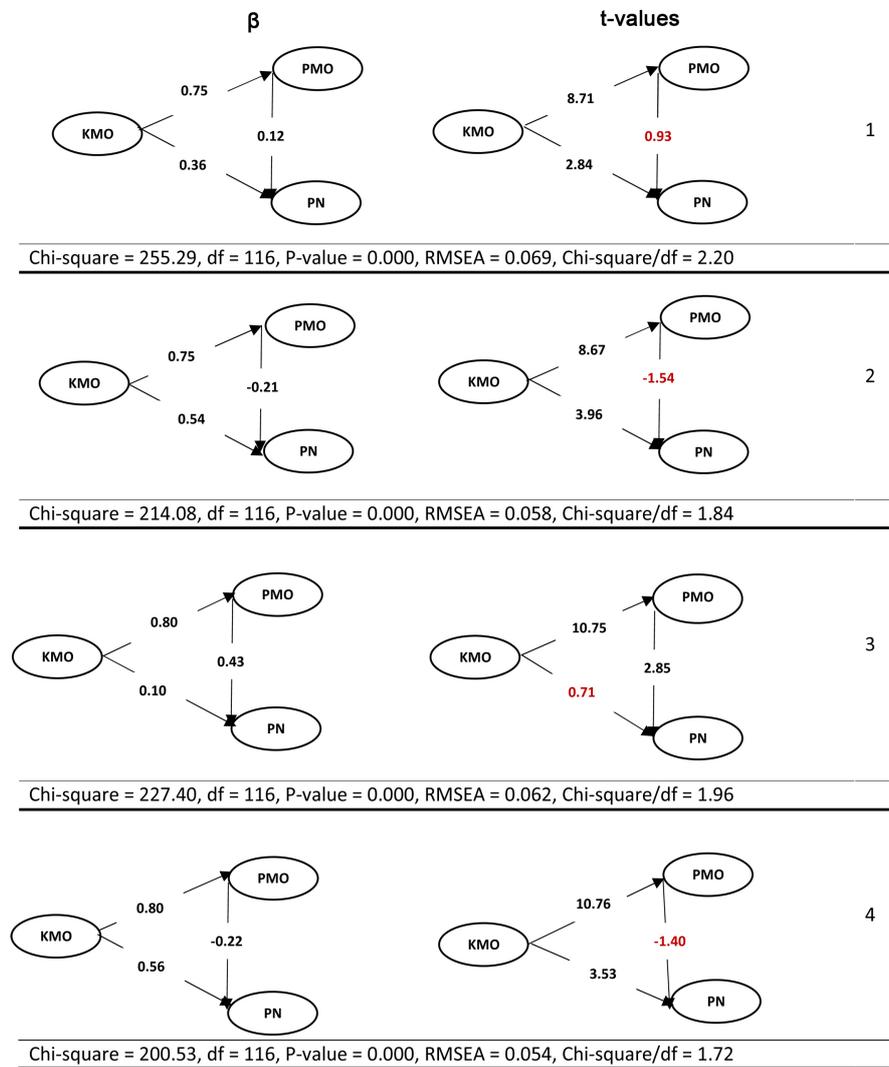


Figure 3. Structural Equation Modeling (SEM) for Hypotheses (4) and (5). KMO: knowledge management orientation; RMO: responsive market orientation; PMO: proactive market orientation; PA: product advantage; PN: product novelty.

(Day, 1994) [45], superior value is continuously created (Narver & Slater, 1990) [37]. This result is consistent with the results of Lin *et al.* (2015) [42], Frishamar *et al.* (2012) [4], and Mu and Di Benedetto (2011) [29] on the relationships among commercialization, knowledge management orientation, and the market. Their findings showed that only the responsive market orientation has a mediating role in the relationship between knowledge management orientation and product advantage.

According to our findings, knowledge management orientation and market orientation can be considered to be appropriate predictor variables for product commercialization. These are considered to be the strategic assets of an organization prescribing the interactions of organizational members as well as the interactions of the organization with the market, competitors, and customers and providing a context for organizations to present products according to market

needs to achieve the desired commercialization (Noble *et al.*, 2002) [64]. Such strategic assets reflect a company's deep set of values and beliefs beyond individual attitudes, unify the available resources and abilities of the organization, and convert them into an integrated whole (Calantone & Griffith, 2007) [65]. Thus, they lead to superior firm performance (Covin & Slevin, 1989) [66]. Competitors can imitate these orientations. Thus, organizations should use such orientations.

Knowledge management requires companies to show dominant behavior. Firstly, a knowledge-based management firm collects implicit data and knowledge from within and outside the organization and provides access to a broad range of financial data. Secondly, a knowledge-based management firm balances formal and informal communication methods and uses techniques such as counseling and coaching as well as technologies such as remote conferencing and video conferencing. Finally, a knowledge-based management firm is responsible for publishing data on the market and technology and must develop and implement marketing programs effectively. In addition, it is opportunistic and flexible when faced with a change in products, processes, and strategies.

Furthermore, firms must analyze the main processes of the market to be proactive, identify unaware customer needs months or years before competitors, and finally present solutions that respond to these needs. They must focus on customers to be responsive to the market as well as understand customers' needs and satisfy them. In addition, they must measure customer satisfaction continuously.

Finally, future research could study the effectiveness of knowledge management and market orientations on commercialization by using other variables including agility and the presence of database systems. The issues used to measure product commercialization in the background are mainly used to measure innovation and new product performance.

Acknowledgements

The second author is deeply grateful to the support provided by JSPS KAKENHI grant number 18K01746.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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