

Lee, Kyungyul; Kwon, Youngsun

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How does the competitive intensity affect the firm's product strategies?

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How does the competitive intensity affect the firm's product strategies?

Kyungyul Lee¹ and Youngsun Kwon²

School of Business and Technology Management, College of Business

KAIST

Introduction

Competitive intensity is a level of competition intensification in a market or an industry. This is expressed in various forms and some paper measured the competitive intensity as the number of products that newly released each year in an industry (Putsis & Bayus, 2001). In other paper, they analyzed the competitive intensity as a market structure such as market concentration (Stavins, 2001) or the number of firms competing in one industry (Giachetti & Dagnino, 2014). Overall, the competitive intensity represents the complex competition within the market. Then how does competitive intensity affects to the company or to the organizational level?

In modern times, corporate product innovation takes place rapidly, and the number of products and companies competing in a market is increasing geometrically. Unlike the past, a market that is monopolized by a single or few companies is hard to find except for public goods. In the smartphone market, 11 companies had competed in 2008, but the number of competing companies had risen dramatically, with more than 45 companies competed in 2016. The number of smartphones also rose sharply, with 50 new phones had launched in 2008, but about 545 new smartphones introduced in 2016. Disadvantage of the increase in the competitive intensity for the firm is that it has a major negative impact on the competitive advantage (D'Aveni, 1994). The decline in the competitive advantage of firms due to the rise of these competitive intensities makes them act newly when they enter or compete in the market.

¹ Doctoral student, kyleeka@kaist.ac.kr

² Professor, yokwon@kaist.ac.kr

However, the strategic forms of these firms have been analyzed in different directions. In the existing paper, it was assumed that firms would behave differently based on firm-level decision. Even if analyzed, they focused on corporate internal investment fluctuations based on organization level. In other words, when the competitive intensity increases, it has been analyzed through financial aspects such as changes in internal R & D investment or the amount invested in marketing. However, it is difficult to understand the correct corporate product strategy from the changes in internal investment. As much as consumers understand corporate strategies through products, changes in firms strategy through products should also be analyzed (Stavin, 1991). In the existing paper, they analyzed that when the competitive intensity increases, firms increase their competitive advantage by (1) product line management and (2) strategic transformation in terms of product innovation. Therefore, in this paper, we analyze the changes in the product strategy of firms by increase of the competitive intensity in the market.

Theoretical background and hypothesis

(1) Product line strategy

As the number of firms competing in the market and the number of products increase, the variation in the product line has been analyzed as a determinant of competitive tools (Draganska & Jain, 2005). The analysis of the product line has been done in several ways. In a specific paper, the product line was analyzed through the number of products (Draganska & Jain, 2005; Giachetti & Dagnino, 2014; Putsis & Bayus, 2001) and some articles estimated through price changes (Balachander & Srinivasan, 1994; Schön, 2010). The expansion of the product line determines the success (Schön, 2010) and competitive advantage (Draganska & Jain, 2005) of the firm, thus due to the importance this paper analyzed the product strategies by considering both.

The product line is one of the strategies to determine the position of the company in the market. This is in the same context that the firm determines the consumer's breadth. The wide product line meets the needs of various consumers (Draganska & Jain, 2005) while relatively narrow product line means that it meets specific consumer needs (Gross, 1967; Kotler & Keller, 2012). This product line is influenced by various internal and external factors in parallel with the customer side (Bayus & Putsis, 1999; Giachetti & Dagnino, 2014;

Smith, 1956). However, sometimes the product line does not change due to internal decisions, which can be seen from Apple's example of smartphone maker. From 2007 to 2009, Apple released only two or three fixed number of high-end smartphones annually (six new smartphone per year for other companies in the same period). These three types also differ only in the internal memory, which is relatively narrow compared to other companies. However, Apple also increased the number of products released every year from 2010, as well as a price dispersion. As such, companies may release certain products through internal decisions, but usually they decide their product line through external market conditions.

Companies achieve two goals through product line changes. First, by changing the product line, it can satisfy the specific customers (Draganska & Jain, 2005). A wide product line is advantageous in that it satisfies various consumers (Bayus & Putsis, 1999; Kekre & Srinivasan, 1990). This is a strategy that is often seen in a small number of competing markets, where the company seeks out different markets to prevent other companies from taking their profits and to pre-empt new markets (Stavins, 1995). In addition, when the needs of the market customers are varied, companies maintain a wide range of prices with various products to satisfy all the demands of customers (Kekre & Srinivasan, 1990; Smith, 1956). However, as the number of competing firms increases, the performance gains of broad market oriented firms are reduced (Sarangi, 2017). Because as a number of companies enter the market, a specific market erosion through their unique positioning make a major crisis for a company with a broad market. Moreover, in the absence of economies of scope, firms are faced with rising costs in expanding product diversity (Bayus & Putsis, 1999; Kekre & Srinivasan, 1990). Therefore, it is important to target a narrow market if the competitive intensity is high. Companies can raise customer loyalty by satisfying specific customers, and they can imprint their brand image with through only high price or low price.

Second, product line changes can create market barriers to prevent new entrants (Requena-silvente & Walker, 2009; Stavins, 1995). Incumbents make market barrier by spreading their product price or quality widely. New entrants decide whether to enter the market by the height of the market barrier. These phenomena appear in the same form for both entrants and incumbents, both of which enter the marketplace and, over time, target empty markets and broad markets, thereby enticing new entrants to enter the crowded market rather than empty markets (Stavins, 1995). These broad product strategy can inhibit other companies' market expansion by preempting the market with a variety of products if there are

fewer competitors. However, such product expansion has a side effect of rising costs for companies as mentioned above. In addition, since many companies have already joined the market, it is no longer feasible for one company to defend a new company with a broad product range. Based on this, the first hypothesis is as follows.

Hypothesis 1. An inverted U-shaped relationship exists between the competitive intensity and the firm's product line (number) extension

Hypothesis 2A. An inverted U-shaped relationship exists between the competitive intensity and the firm's product line (price) extension

Hypothesis 2B. An inverted U-shaped relationship exists between the competitive intensity and the firm's product unit-line (price) extension

(2) Firm's incremental product innovation strategy

Product innovation is done in several ways, but it is usually analyzed in two ways. First, radical innovation is one of the innovative ways to create new markets and customers by bringing new products to market (Dess & Beard, 1984; John, William, & Robert, 1984). Radical innovation is usually achieved by pursuing a unique strategy and structure during the process adoption period (John et al., 1984). Second, innovation is also achieved through incremental innovation, which means improving the performance of each product component while maintaining the established design (Henderson & Clark, 1990). Incremental innovation is mainly done when reinforce existing traditional marketing oriented strategies and arrange existing structures (John et al., 1984). The purpose of this study is to identify strategic changes within an industrial group, and also most innovations are focused on incremental innovation rather than radical thus we focused on the incremental innovation for this paper.

When a particular design is recognized in the marketplace, product innovation begins (Sahal, 1981) and companies show incremental innovation by developing the best performing product or by quickly adopting the innovation created by the competitor (Banbury & Mitchell, 1995). There are three major benefits to achieving incremental innovation as a company. (1) Incremental innovation, within an industry group, helps firms maintain their competitive positions by improving core competencies (Abernathy & Clark, 1985). This is

because, sustained incremental product innovation improves competitiveness in a variety of areas such as productivity, quality, flexibility and responsiveness (Bessant, 1992). The rise of the various dimensions helps to minimize firms from various negative market effects and make them to acquire opportunities in the market faster than competitors. (2) Incremental innovation plays a role in preventing other firms from entering the market by raising the competitive advantages (Balachander & Srinivasan, 1994). Generally, incumbent launches high quality products at low prices, which prevents new entrants by the price advantage. This is because a new company has high fixed costs to produce high quality products when it enters the market, but existing companies can produce products at an optimal price because the production line is already established. (3) Incremental innovation also positively affects corporate performance. As a result of the analysis in the existing paper, the more frequent the incremental innovation firms shows, the higher the market share, the longer the company survived in the market (Banbury & Mitchell, 1995). The results show that the relationship with time is also significant.

Incremental innovation is not equally affecting the enterprise's profit. The influence of the market characteristics on the firm is very different (Acs & Audretsch, 1987; Banbury & Mitchell, 1995). In markets where barriers to market entry are low and other competitors' technologies are easy to acquire, it is dangerous to introduce high technology first. Product development always has trade-offs, which can create reputation and capitalizing cost dynamics by launching products in the market, but it has a side effect in terms of risk and cost that can fail (Lilien & Yoon, 1990). Many companies have already entered the market, thus that profit from incremental innovation is less than that of the initial market (Banbury & Mitchell, 1995). This phenomenon is also shown in the imitation feature. When market innovation begins to take place in an incremental manner, companies will follow other companies' products to mitigate rivalry and reduce risk from other factors. As other firms follow their own products, firms will lose their market advantage through innovation and consequently lose their competitive advantage (Lieberman & Montgomery, 1988). The hypothesis based on this is as follows.

Hypothesis 2. An inverted U-shaped relationship exists between the competitive intensity and the firm's incremental innovation

Data

To understand the strategy that reflects the product characteristics and the prices, we first analyzed smartphones that has been sold in the global market during the eight years. The data consist of price and technical attributes of smartphones sold from 2008 to 2016 and it is collected in the GSMarena site (<https://www.gsmarena.com/>). However, we assigned the lag term for the independent variables thus 2007 also included for the independent variables. There were 2924 different smartphone models released from 67 manufacturers during the eight years.

Each model contains the model's identification number, 17 different technical attributes, 67 manufacturers' name and the released date and the retailed price. The smartphone models are classified by their brand names. However, if the brand names of any two models are the same but have different types of technical attributes, we categorized the models as different ones. For example, Apple released iPhone 6 for the three different internal memory versions. In this case we included all three data objects regardless of the brand name. Therefore, this paper includes all different technical types of the models that the manufacturer introduced in the global market. For the global smartphone manufacturer's market share we collected the data from the Statista (<https://www.statista.com/>).

Measures

In this paper, we analyze the influence of competitive intensity on the product strategy by two methods. For this analysis, we took a lagged term on independent variable thus made one-year difference between the dependent and independent variables. The independent variable is the period from 2007 to 2015 and the dependent variable is from 2008 to 2016. The description of each variable is as follows.

Dependent variable

(1) Product line strategy (product perspective)

The product number and price dispersion are used to analyze the product line strategy of each firms. In the first analysis, the increase in the number of products was

measured. We measured whether companies increased or decreased their smartphone numbers in proportion to last year and took natural logarithms based on existing papers for more precise analysis (Giachetti & Dagnino, 2014; Putsis & Bayus, 2001). However, the results were also the same with raw data without any natural logarithm term. Second, we measured the price dispersion volatility. This is calculated based on the difference between the prices of the most expensive and the least expensive of the smartphones released by companies each year.

$$\text{Log} [(\max_{i,t} \text{Price}_{i,t} - \min_{i,t} \text{Price}_{i,t}) - (\max_{i,t-1} \text{Price}_{i,t-1} - \min_{i,t-1} \text{Price}_{i,t-1})] \quad (1)$$

However, in this case, there is a disadvantage that the number of products cannot be considered. For example if Company A launches two mobile phones with a price difference of \$ 100, and Company B launches five mobile phones with a price difference of \$ 100, then from the first equation it shows both two companies have the same price dispersion. However, for the consumer, they may feel that company A has a wider price range. Therefore, in order to take this into account, we divided the number of smartphones in the Equation (1).

$$\text{Log} \{[(\max_{i,t} \text{Price}_{i,t} - \min_{i,t} \text{Price}_{i,t}) / (n_{i,t} - 1)] - [(\max_{i,t-1} \text{Price}_{i,t-1} - \min_{i,t-1} \text{Price}_{i,t-1}) / (n_{i,t-1} - 1)]\} \quad (2)$$

(2) Firm's incremental product innovation strategy

In order to measure the innovation of smartphones, it is necessary to analyze the components in the product. Components are defined as the function that do their own performance roles in the core design concept (Clark, 1985). Since the dominant design has already emerged in the incremental innovation, the technological standard has already been set in the market. Therefore, the core component configuration aims only to improve the performance of the retained functions (Henderson & Clark, 1990). Thus, we selected 5 key components based on the previous articles among 17 elements of smartphone, and measured the incremental innovation improvement of each smartphone manufacturers. Pixel, internal memory, ram, primary camera, secondary camera were included in the main key elements.

We used the capability stretching method to measure the innovation capability of each firm (Wang & Chen, 2018). In the previous paper, they compared the innovation capacity of companies with the market or competitors through capability stretching. However, we measured the incremental innovation per year by within company. Because the firms adjust their innovation capacity according to the competitive intensity thus it is more appropriate to look at own internal adjustments rather than simply comparing with others. Following this process, each year, the degree of product innovation within each company was obtained for each component then we standardize each component improvement and added to make a one dimension.

$$Stretch(Component)_{i,t,s} = \frac{Component_{i,t-1,s} - \max_{i,t-1,s} \{Component_{i,t-1,s}\}}{\max_{i,t-1,s} Component_{i,t-1,s}} \quad (3)$$

Independent variable

Competitive intensity

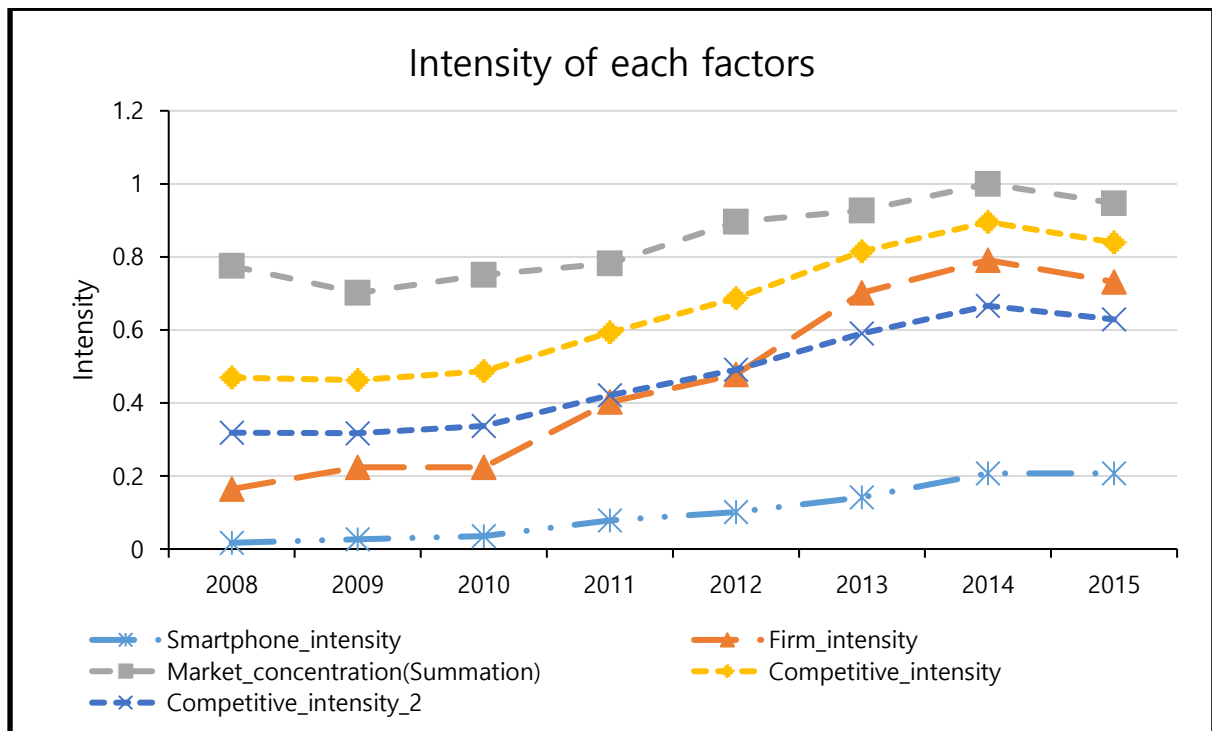
Competitive intensity is a measure of competitive intensification of the market. This indicator is measured through firm intensity or market concentration. In this paper, we analyze the two factors as one variable in order to see the overall intensity affection (Giachetti & Dagnino, 2014). This is expressed in equation (4). There is one limitation that, previous paper only analyzed the competitive intensity of the market. On the other hand, the number of products competing in the market can also affect the company. Therefore we also used (5) in order to consider the number of products competing each year. The reason why we can add multiple variables and analyze them as a single variable is that all intensities are increasing with similar trends, as shown in figure 1. Therefore, even if simple summation is performed without weight, there is no significant change in the result.

Competitive intensity

$$\frac{\left[\frac{nfirms_t}{\max(nfirms)} \right] + \left\{ \frac{1}{\left[\frac{concentration_t}{\min(concentration)} \right]} \right\}}{2} \quad (4)$$

Competitive intensity (including products intensity)

$$\frac{\left[\frac{nfirms_t}{\max(nfirms)} \right] + \left\{ \frac{1}{\left[\frac{concentration_t}{\min(concentration)} \right]} \right\} + \left[\frac{nproducts_t}{\max(nproducts)} \right]}{3} \quad (5)$$



Control variable

In order to see only the effect of the competitive intensity on the strategic transformation of the company, various control variables were included in the analysis. In the case of a newly entering company, the price range and the number of products are 0 for the first independent variable, which means that the next year will show a large value when viewing the difference between the previous year. Therefore, New entrant was included in the analysis process as a dummy to control it, and intensity new firms were also measured as control variables. In addition, we have also taken into account the increasing percentage of smartphone users around the world, in order to control the changes that can be caused by a decrease or increase in smartphone users in the global market. We also considered the firm smartphone founded year, and also considered the strategic behavior of market leaders. Year fixed effect and firm fixed effect were also considered.

Results

	(1) Increase Number	(2) Increase Number	(3) Increase Number	(4) Price Dispersion	(5) Price Dispersion	(6) Price Dispersion	(7) Unit Price Dispersion	(8) Unit Price Dispersion	(9) Unit Price Dispersion
Competitive intensity		-3.2221 (0.000)***			1.4848 (0.009)***			11.0073 (0.014)**	
Competitive intensity square		1.5145 (0.000)***			-1.3774 (0.000)***			-7.1781 (0.006)***	
Competitive intensity (product included)			-3.6998 (0.000)***			1.8730 (0.005)***			13.3029 (0.012)**
Competitive intensity square (product included)			2.3455 (0.000)***			-2.4017 (0.000)***			-11.8377 (0.005)***
Intensity new firms	0.3909 (0.000)***	0.5385 (0.000)***	0.4988 (0.000)***	0.0124 (0.856)	-0.0003 (0.997)	-0.0821 (0.414)	2.2641 (0.052)*	1.0735 (0.129)	0.9784 (0.171)
China	-0.1377 (0.007)***	-0.1376 (0.007)***	-0.1376 (0.007)***	0.0389 (0.858)	0.0389 (0.858)	0.0389 (0.858)	0.3615 (0.683)	0.3615 (0.683)	0.3615 (0.683)
Global smartphone usage percentage changes	-0.0452 (0.648)	0.3536 (0.031)**	0.2528 (0.104)	2.6468 (0.000)***	0.0426 (0.806)	-0.0484 (0.774)	-3.1293 (0.117)	-3.4573 (0.084)*	-3.6177 (0.060)*
Firm phone founded age	0.1799 (0.000)***	0.1799 (0.000)***	0.1799 (0.000)***	0.099 (0.002)***	0.099 (0.002)***	0.0990 (0.002)***	-0.4440 (0.006)***	-0.444 (0.006)***	-0.4440 (0.006)***
Year	-0.0228 (0.1140)	0.1205 (0.006)**	0.1055 (0.008)***	0.3239 (0.000)***	0.0291 (0.282)	0.0217 (0.412)	-0.4129 (0.122)	-0.4454 (0.146)	-0.4707 (0.112)
New entrant	0.0319 (0.000)***	0.0319 (0.000)***	0.0319 (0.000)***	0.0212 (0.035)**	0.0212 (0.035)**	0.0212 (0.035)**	-0.1950 (0.000)***	-0.195 (0.000)***	-0.1950 (0.000)***
Leader pre-increase number	0.0348 (0.000)***	0.1372 (0.000)***	0.1276 (0.008)***						
Leader pre-increase price dispersion				0.0001 (0.003)***	0.000 (0.846)	0.0000 (0.505)			
Leader pre-increase price unit-dispersion							1.8379 (0.014)**	1.2754 (0.023)**	1.3251 (0.015)**
Firm Dummies	Included	Included	Included	Included	Included	Included	Included	Included	Included
Year Dummies	Included	Included	Included	Included	Included	Included	Included	Included	Included
observations	290	290	290	228	228	228	236	236	236

***p<0.01; **p<0.05, *p<0.10

	(10) Incremental Innovation	(11) Incremental Innovation	(12) Incremental Innovation
Competitive intensity		143.2682 (0.000)***	
Competitive intensity square		-86.8467 (0.000)***	
Competitive intensity (product included)			171.3549 (0.000)***
Competitive intensity square (product included)			-141.1654 (0.000)***
Intensity new firms	-4.0534 (0.012)**	-13.9528 (0.000)***	-14.86543 (0.000)***
China	-2.7322 (0.612)	-2.6634 (0.630)	-2.7322 (0.612)
Global smartphone usage percentage changes	16.5417 (0.011)**	-9.1240 (0.197)	-8.3342 (0.231)
Firm phone founded age	-4.3205 (0.004)***	-4.320539 (0.004)***	-4.3205 (0.004)***
Year	1.2763 (0.116)	-2.9287 (0.014)**	-2.9121 (0.016)**
Leader pre-incremental innovation	0.2466 (0.191)	-0.0619 (0.714)	-0.0637 (0.719)
Firm Dummies	Included	Included	Included
Year Dummies	Included	Included	Included
observations	214	214	214

***p<0.01; **p<0.05, *p<0.10

Table 1 and Table 2 show the effect of competitive intensity on the firm's product strategy. Models 2 and 3 analyzed the effect of competitive intensity on the product line of the firm through the number of products. Hypothesis 1 predicted that the inverted U-shaped relationship exists between the competitive intensity and the firm's product line extension. However, in the result, the relationship between the two is reversed as a u-shape. It means that as the competitive intensity in the market increases, the company initially reduced the number of products but increased the number of products again when the competitive intensity reached a certain limit. These results were the same for both competitive intensities.

One the other hand, the product line in terms of price dispersion showed the same as Hypothesis 2. In Model 4 and 5, the inverted U-shape appears between price dispersion and competitive intensity. Firms increased their price dispersion when their competitive intensity is low, but decreased their price dispersion after competitive intensity has crossed some point. These results were the same in unit price dispersion of models 7 and 8 and same for both two competitive intensities. However, there was a significant difference in Firm phone established

age, which showed a positive correlation with Firm phone established age and total product price dispersion / competitive intensity. In other words, the longer the firm is in the market, the wider the product line they sustained. However, in terms of unit price dispersion, it was reversed. The longer companies were in the market, the smaller their unit price dispersion they sustained. The same result was found in the product innovation strategy of a company. Looking at model 11 and 12, companies have shown high innovation when the competitive intensity is low, but they have reduced their innovation capacity when the competitive intensity is high. Companies have also shown lower innovations as more new companies enter the market. The market leader has no influence on the innovativeness of other firms.

Conclusion & Limitation

In modern times, corporate product innovation takes place rapidly, and the number of products and companies competing in a market is increasing geometrically. Unlike the past, a market that is monopolized by a single or few companies is hard to find except for public goods. In these competitive societies, the competitive advantage can not be maintained and will eventually weaken. Therefore, it is important for companies to maintain a competitive advantage. In the previous paper, it was suggested that a competitive advantage could be achieved through strategic transformation. Therefore, in this paper, we analyze the effect of competitive intensity on the strategic transformation of company in terms of product line and product innovation strategy.

Competition has led to similar forms of strategic transformation. First, companies have reduced their product lines when competitive intensity is low. However, companies have increased their product lines again after the competitive intensity has reached some point. In other words, the more competition in the market, the more products are introduced. This phenomenon also occurred when new entrants entered the market. As more new entrants entered the market, more companies launched more products. However, companies have shown that they reduce their product prices in the process of product launch. As the competition grows, companies become more and more focused on narrower markets. It can be seen that companies are realizing a local scope economy scope by satisfying a narrower consumer than a broader consumer. It was also found that companies are doing this strategy to imprint the brand on consumers. But the time does not affect the shape of firms. On the

other hand, the period in which the company is in the smartphone market has become an important factor. It means that the longer the firm is in the market, the greater the number of products and the price change.

Second, companies have changed their product innovation strategy according to the competitive intensity. In the market with less initial competition, the firm shows more innovations in order to inhibit other companies from entering the market. It means firms showed higher innovation when market competition is low. However, in the case of intensified competition, companies showed lower innovation. It is a phenomenon that appears when innovation is no longer important in the marketplace, and companies tried to search and enhance their capabilities in other ways than innovation.

However, there are some limitations in this paper. First, firm characteristics such as firm size should be considered. Strategy is similar to the competence or characteristic of a company. Thus, it is impossible to understand the generalized phenomenon without considering it. Second, the result of this paper is a special case of the smartphone market that is difficult to generalize. The smartphone market has grown rapidly in the short term. Therefore, there is a big difference from other general technologies thus it is insufficient to generalize without considering these differences. In future research, we should find out specific factors of the smartphone market and analyze the effect of competition in parallel.

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