Management Studies, October 2015, Vol. 3, No. 9-10, 247-261
doi: 10.17265/2328-2185/2015.0910.003

Comparative Study on FFE Activities Between Japanese and Korean NPD Project Success

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This study shows the impact of fuzzy front end (FFE) phase during innovation process on new product development (NPD) project success in two East Asian countries—Korea and Japan was explored via employing comparative study. Authors decided to consider two East Asian countries' successful periods as comparison samples for the study of this issue. The 1980s are considered to be "golden age" of Japanese manufacturing firms when they were extremely successful on global market. Korean firms are enjoying competitive advantage in the late 2000s and the beginning of the 2010s. A conceptual model was developed based on previous research. The model was tested using data from 293 Korean manufacturing firms in the late 2000s and from 540 Japanese manufacturing firms in the late 1980s using structural equation modeling (SEM) technique. In both countries, the effect of intensity of planning on efficiency, prior to the development, was high. Moreover, effect of market uncertainties on effectiveness was significant. Therefore, effective initial planning and good analysis of market prior to the development have positive impacts on NPD project success. In the late 80s, in the period of stability of the economy in the world, the Japanese firms were successful concentrating more on FFE activities, such as market and technological research and initial planning. However, in the 2000s when the world economy started to change so fast and the demands for the goods change so fast, the Korean firms became more successful, thanks to flexibility in the system of NPD project strategies where system was not fixed to the initial plans but where the changes within the project execution phase were allowed. Thus Korean and Japanese firms had different strategies in NPD process in the two different periods. Japanese firms were concentrated more on FFE activities and tended to keep initial plans during development process, while the Korean firms were more flexible in project execution phase allowing dramatic changes to the initial plans.

Keywords: new product development (NPD), fuzzy front end (FFE), structural equation modeling (SEM), smart PLS, project execution phase

Introduction

In the 1980s, many Japanese manufacturing firms had an extremely successful business on a global basis. Recently, Korean manufacturing companies, such as SAMSUNG, LG Electronics, and Hyundai Motors, which

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have been replaced by Japanese manufacturing firms, have been enjoying considerable success leading the world market in many different product fields. Therefore, there is a great interest in the factors driving this success.

Cooper and Kleinschmidt (1994) found that the greatest differences between winners and losers were in the quality of pre-development activities. This early stage of an innovation process is called “fuzzy front end (FFE)” and it is assumed that this plays an important role in explaining the success of 1980’s Japanese firms and current Korean companies.

The FFE, a term made popular by Smith and Reinertsen (1991), is considered the first stage of the new product development (NPD) process and roughly covers the period from the generation of an idea to its approval for development or its termination (Murphy & Kumar, 1997). Cooper (1988) distinguished four phases of the FFE: the generation of an idea, initial screening, preliminary evaluation, and concept evaluation. He stressed the importance of both market-related and technical activities. There have been a lot of studies in literature on key factors driving the success. Cooper and Kleinschmidt (1994) stated that the greatest differences between winners and losers were found in the quality of pre-development activities. So-called “pre-development activities” in literature is also called FFE.

Khurana and Rosenthal (1998) defined front end activities as pre-phase zero activities (idea generation, market analysis, and technology appraisal), phase zero activities (identification of customer needs, market segments, and competitive situations; performing technology evaluation of current capabilities and requirements and alignment with existing business and technology plans; identification of core product requirements; testing the concept; specification of the resources needed to complete the project; and identification of key risks and challenges), and phase one activities (definition of the product and project). As shown in Figure 1, FFE includes the very first activities within the NPD process (phase I and II) and delivers a list of specifications.

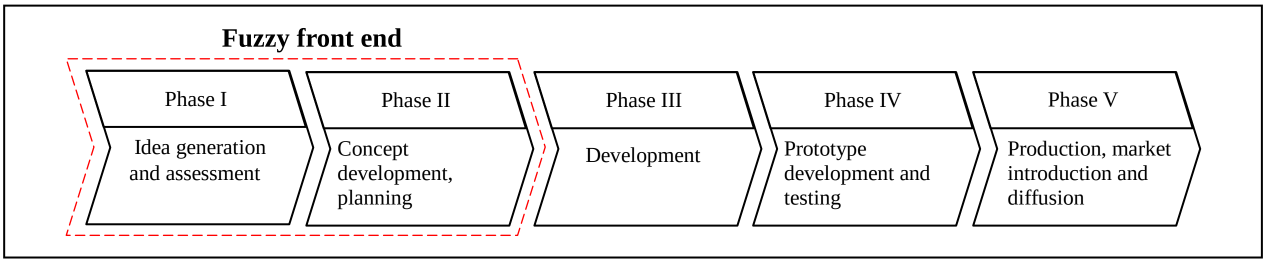

Figure 1. Definition of the FFE during NPD process. Source: Herstatt, Verworn, and Nagahira (2004).

The importance of FFE was highlighted by several studies (e.g., Shenhar, Tishler, Dvir, Lipovetsky, & Lechler, 2002; Herstatt et al., 2004; Verworn, Herstatt, & Nagahira, 2008; Verworn, 2009; Frishammar, Floren, & Wincent, 2011). According to Brem and Voigt (2009), the front end of innovation is considered to be the most critical phase of innovation process. Backman, Börjesson, and Setterberg (2007) stated that the greatest opportunities for improving the overall innovation process lie in the very early phases of NPD. In creating new product success, the competence in managing the FFE is an important factor (Kim & Wilemon, 2002). Brentani and Reid (2012) discussed the key factors of individual decisions regarding information flow within the FFE affecting the effectiveness. Verganti (1999) argued that anticipation (early phase, i.e., FFE) and reaction (implementation, i.e., project execution) strongly interact with each other through planned flexibility.

The East Asian companies support cutting-edge technologies to the world. Impact of FFE activities on new product success in East Asian companies attracts interests of researchers. Song and Parry (1997a; 1997b), conducted a cross-national comparative study of NPD processes in 788 Japanese and 612 American NPD projects and concluded that the cross-functional integration and product competitive advantage are two key determinants of new product success. Verworn et al. (2008) conducted a large scale questionnaire survey analysing data from 497 Japanese manufacturing firms, in order to reveal the impact of FFE activities on NPD project success. A decision-making framework was proposed in order to deal with uncertainty of the fuzzy front-end of production development and it was applied to portfolio analysis in an electronics firm in Korea by Oh, Yang, and Lee (2012). In the studies of Ho and Tsai (2011), the analysis of data survey from 139 Taiwanese high-tech firms confirms the effects of strategic goal, proficient procedure, and innovative culture on font end of innovation performance.

In this paper, authors are considering the data of Japanese manufacturing firms collected in 2003. In the data considered, the analysis of the product success in the market took from 10 to 15 years. That refers to the end of 1980s, a successful period of Japanese manufacturing firms. Korean manufacturing companies are enjoying competitive advantage in the sector of shipbuilding and in recent years have improved quickly in sectors like optical and precise machinery, chemicals, iron and steel, and electronics including electronic parts with respect to other East Asian manufacturing companies (Fukuchi, 2010). So the data of 2012 are considered where the average evaluation of product success in the market is two years or less, the time which refers to successful period of Korean manufacturing firms.

The aim of this study therefore is to reveal the impact of FFE activities on NPD project success of Korean and Japanese companies. Furthermore, authors clarify the factors of the competitive advantages of manufacturing companies by comparing the FFE activities between Korean and Japanese manufacturers' NPD project success. In order to gain insight into the FFE activities, a conceptual model is suggested and tested with structural equation modeling (SEM).

The paper is organized as follows. After this brief introduction (section 1), the conceptual model is described and provided more details about hypotheses and measures to test conceptual model in section 2. Section 3 describes research method and analysis results. Section 4 discusses the differences and the similarities concerning FFE activities between Korean and Japanese NPD projects. In section 5, this paper closes with conclusions and the managerial implications.

Conceptual Model

Development of the Model

The framework of this research is based on recent works in literature on NPD. Verworn et al. (2008) analysed the direct impact of FFE activities on the project success. The sole influence of front end activities on market success becomes difficult to measure because of the noise produced on the way from one phase to another towards the NPD success (Schweitzer & Gabriel, 2012). In work of 2009, Verworn (2009) analysed the direct and indirect impacts of FFE activities on NPD project success. This approach is adopted where the direct impact of FFE phase as well as the impact of other phases on NPD project success was analysed. Basically, authors concentrated on factors that are considered to be fundamental at the FFE phase. According to the literature review, the researchers are mostly concentrated on reduction of risks and uncertainties during the NPD process (Moenaert, Deschoolmeester, De Meyer, & Souder, 1992; Kim & Wilemon, 2002; Verworn et al., 2008). Successful project teams are characterized by maximum uncertainty reduction during planning stage (Moenaer, De Meyer, Souder, & Deschoolmeester, 1995). Galbraith (1973) gave definition for uncertainty as follows: Uncertainty is the difference between the amount of information required to perform a particular task and the amount of information already possessed by the organization.

The more a risk or uncertainty can be reduced during idea evaluation in the front end of the innovation process, the lower the deviations from the specifications of the subsequent project execution phases are, and hence the greater the success in product development is. This information processing or uncertainty reduction approach was also applied by Verworn et al. (2008) and Verworn (2009).

Hypotheses and Measures

The model proposes three key front end factors that determine NPD projects' effectiveness and efficiency: "reduction of market uncertainty", "reduction of technical uncertainty", and "intensity of (initial) planning", before development was operationalized in accordance with approaches recommended by Peter (1979) and Jarvis, MacKenzie, and Podsakoff (2003) (Figure 2). The factor "reduction of market uncertainty" in this model refers to: knowledge about customers' needs, wants, and specifications; customer requirements; size of potential market; price sensitivity; "appeal" characteristics; and competitors before development. The items were taken from Song and Parry's constructs "marketing proficiency" (1997a, p. 74) and "proficiency in the business and market opportunity analysis stage" (1997b, p. 14), focusing on market-related items relevant at the FFE phases.

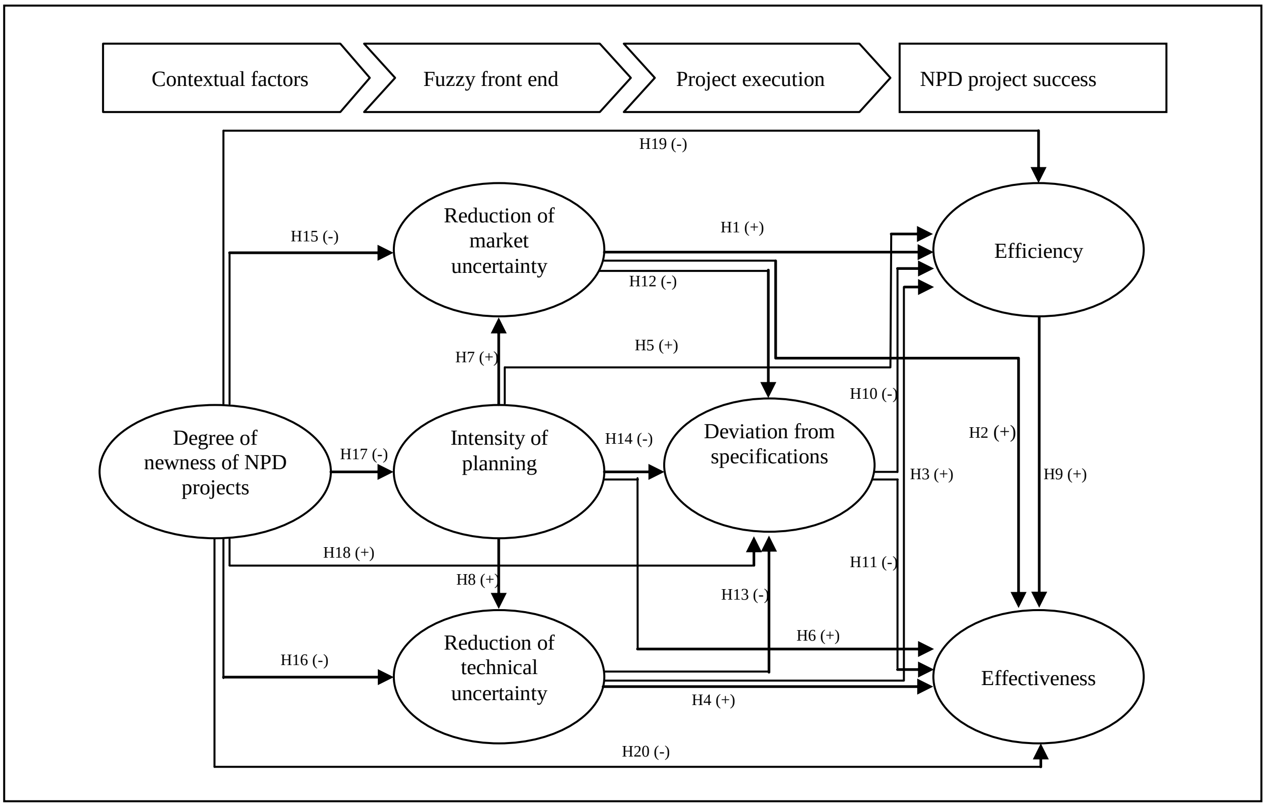

Figure 2. Hypothesized relations between FFE factors and NPD project success. Source: Authors.

Two factors for NPD success at the project level were considered: "efficiency" and "effectiveness". There have been controversial discussions in the literature about success measures, e.g., Pinto and Slevin (1988), Hauschildt (1991), Ernst (2001), and Verworn (2009). With regard to the point of time when the measurement takes place, respondents were asked to describe the development of the last product brought to market (last-incident method). For determining "efficiency", respondents assessed the degree of agreement between financial and personnel resources planned during the FFE and those actually required (Dvir & Lechler, 2004). "Effectiveness" evaluates the project's outcome, such as meeting profit targets, sales volume targets, market share targets, customer satisfaction, and competitive advantage achieved by the new product from the point of view of different stakeholders. Author measured "effectiveness" by slightly modifying scales from the studies of Lynn, Reilly, and Akgun (2000) and Pinto and Slevin (1988). Hypotheses 1 and 2 are as follows:

Hypothesis 1: The efficiency of NPD projects is positively affected by the degree of reduction of market uncertainty during the FFE;

Hypothesis 2: The effectiveness of NPD projects is positively affected by the degree of reduction of market uncertainty during the FFE.

Following Cooper and Kleinschmidt (1987) and Song and Parry (1996), the factor "reduction of technical uncertainty" refers to a well-understood technology, product's specifications, technical requirements, technical feasibility, and anticipation of technical problems before development. Hypotheses 3 and 4 are as follows:

Hypothesis 3: The efficiency of NPD projects is positively affected by the degree of reduction of technical uncertainty during the FFE;

Hypothesis 4: The effectiveness of NPD projects is positively affected by the degree of reduction of technical uncertainty during the FFE.

The factor "intensity of planning" refers to the initial planning activities before the start of development and is based on the factors "planning quality" and "proficiency of the pre-development planning process" by Dvir and Lechler (2004) and Song and Parry (1996). Breaking the project into work packages, timings, resource allocation, a detailed cost plan, and responsibilities of team members are described in the initial plan. Hypotheses 5, 6, 7, and 8 are as follows:

Hypothesis 5: The efficiency of NPD projects is positively affected by the intensity of planning before the start of development;

Hypothesis 6: The effectiveness of NPD projects is positively affected by the intensity of planning before the start of development;

Hypothesis 7: The degree of reduction of market uncertainty during the FFE is positively affected by the intensity of planning before the start of development;

Hypothesis 8: The degree of reduction of technical uncertainty during the FFE is positively affected by the intensity of planning before the start of development.

Several empirical studies show a strong correlation between project efficiency and project effectiveness and/or different aspects of project effectiveness (Rubenstein, Chakrabarti, & O'Keefe, 1976; Maidique & Zirger, 1984; Dvir & Lechler, 2004). Thus, here comes hypothesis 9:

Hypothesis 9: The effectiveness of NPD projects is positively affected by NPD efficiency.

The factor deviation from specifications includes seven items: changes in technical concepts; emergence of new elements; meeting up with surprises and unforeseen findings; deviations from planned procedures; changes in project objectives; absence of design iterations; and formation of new concept definitions. Consequently, several studies show that well-defined deliverables and procedures during the FFE reduce deviations from these specifications during project executing and therefore foster project to success (Gupta & Wilemon, 1990; Khurana & Rosenthal, 1997). Thus, hypotheses 10, 11, 12, 13, and 14 are as follows:

Hypothesis 10: The efficiency of NPD projects is negatively affected by deviations from specifications during the project execution phase;

Hypothesis 11: The effectiveness of NPD projects is negatively affected by deviations from specifications during the project execution phase;

Hypothesis 12: The reduction of market uncertainty during the FFE reduces deviations from specifications during the project execution phase;

Hypothesis 13: The reduction of technical uncertainty during the FFE reduces deviations from specifications during the project execution phase;

Hypothesis 14: Intensive planning prior to the development reduces the deviations from specifications during the project execution phase.

Griffin (1997) and Khurana and Rosenthal (1998) stated that the degree of newness of a NPD project for a firm is a key contextual factor. “Degree of newness” makes it difficult to reduce uncertainties and develop an effective plan during the FFE (Song & Montoya-Weiss, 1998; Verworn et al., 2008). The unpredictability of time paths associated with the degree of newness makes it difficult to reduce uncertainties and develop an effective initial planning during the FFE (Verworn et al., 2008). Degree of newness include: difference in technical knowledge, technical components required, production lines, required process, target market, distribution channels, advertisement of such product, capital, competence and skills, organizational changes, and strategy. Thus, hypotheses 15, 16, 17, 18, 19, and 20 are as follows:

Hypothesis 15: The high degree of newness makes it more difficult to reduce market uncertainty during the FFE;

Hypothesis 16: The high degree of newness makes it more difficult to reduce technical uncertainty during the FFE;

Hypothesis 17: Initial project planning differs according to the degree of newness of the NPD projects;

Hypothesis 18: A higher degree of newness of initial product concept leads to more deviations from specifications during the project execution phase;

Hypothesis 19: A higher degree of newness of initial product concept leads to lower efficiency of the NPD process;

Hypothesis 20: A higher degree of newness of initial product concept leads to lower effectiveness of the NPD process.

Research Method and Analysis Results

In this study, the data of two promising East-Asian countries were considered. One of the most important aspects of cross-country comparative study is considering countries with a similar economic condition. The comparison periods which refer to the late 1980s for Japanese manufacturing firms and the late 2000s for Korean manufacturing firms are considered to be very successful period for both countries. Thus, these data were chosen and results were supposed to reveal strategies of NPD process for successful periods of two East-Asian countries.

The same questionnaire was used in order to compare the results of Korean manufacturing firms’ data of 2012 with the data of works in literature of Verworn et al. (2008) where data of Japanese manufacturing firms dated 2003 were used.

Korean Data Collection Procedure

Pilot study was conducted in order to check the validity of factors to be considered which are mentioned in previous works in literature. The questionnaires were translated to Korean and correct interpretation was verified. In total, 1,650 revised standardised questionnaires were sent to researchers and development directors of Korean companies; 418 of these companies are listed on the Korea Composite Stock Price Index (KOSPI) list; most of them are manufacturing. Two hundred and forty-two companies in the sample are emerging companies with turnover more than 900 million US dollars and 936 of companies in the sample are small and medium sized innovative tech-focused companies with turnover over 90 million US dollars. Total number of 301 companies responded to which represents response rate of 18.2%. Out of these, 293 samples were included in the analysis. The seven-point Likert-type scales were used ranging from 1 = "strong disagree" to 7 = "strong agree" and 1 = "objectives not achieved" to 7 = "objectives exceeded". Categorization of new product concept of the 293 samples that were included in the analysis was made according to Booz-Allen and Hamilton (1982). Percentage of new to the world products is 37.5%, extented or new product line was concept of 26.6% of companies, and product modification was concept of 13.3%, repositioning in Figure 3.

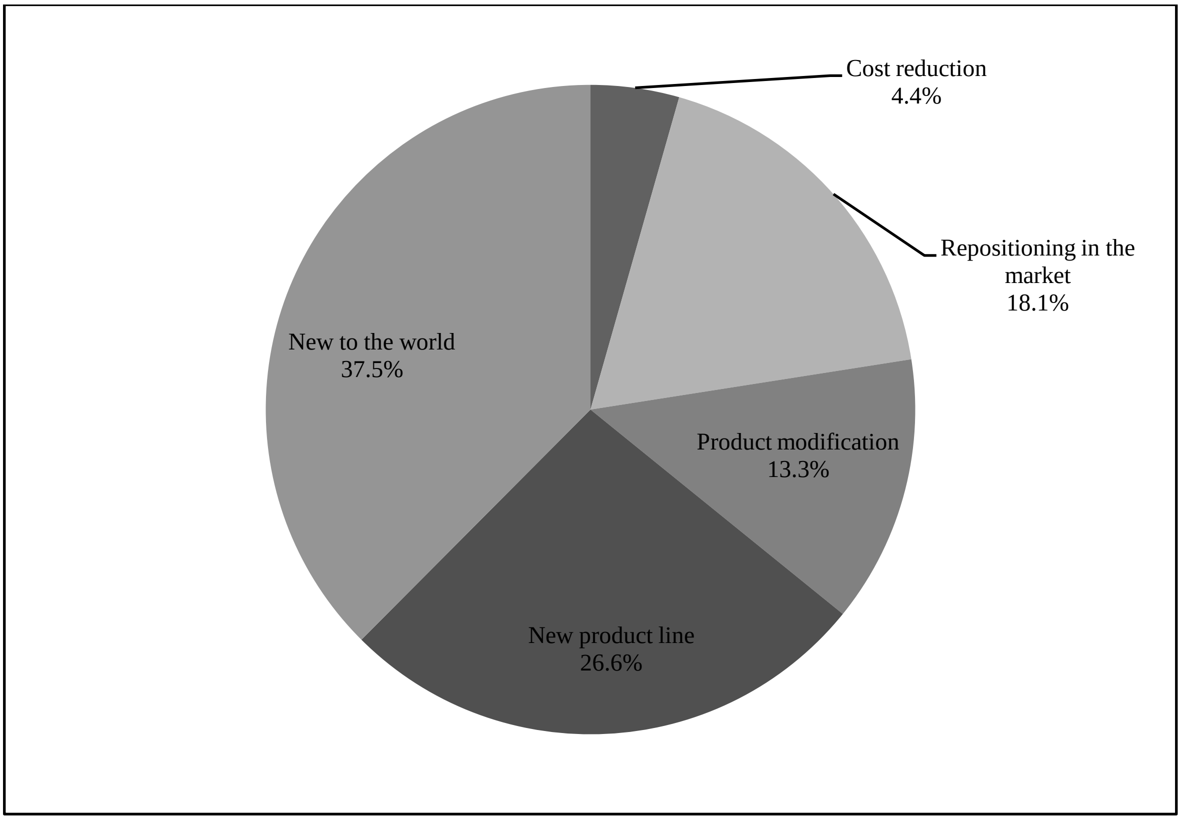

Figure 3. Categories of Korean NPD projects. Source: Authors.

The market was 18.1% and cost reduction was concept of 4.4% of companies (Figure 3). Summary about sample considered consisting of 293 Korean manufacturing companies is presented. Two hundred and eighty-three considered companies revealed number of employees: The range is between two and 100,000 employees (Figure 4). Two hundred and seventy-five considered Korean companies revealed annual sales: The range is from 89 thousand US dollars to 123,117 million US dollars (1USD = 1.129KRW) (Figure 5).

Figure 4. Number of employees (Korean companies). Source: Authors.

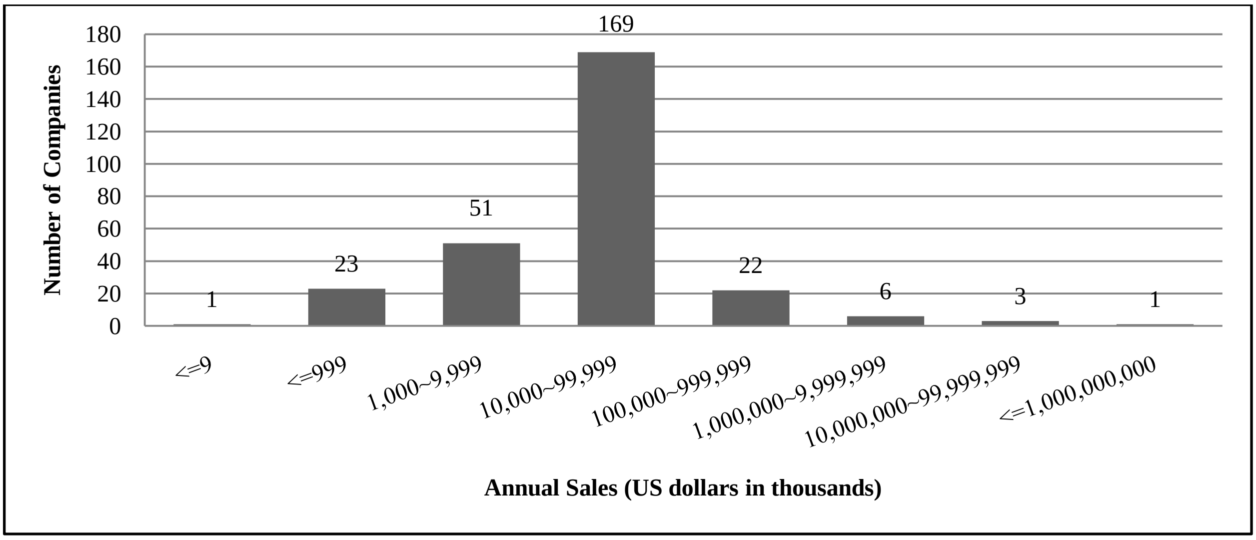

Figure 5. Annual sales (Korean companies). Source: Authors.

Japanese Data Collection Procedure

In the Japanese data collection procedure, some modifications were introduced to the initial questionnaires used in literature after conducting pilot study. Thus the factors obtained from previous works and its translation into Japanese were verified. Two corporate databases were used for Japanese data collection procedure. One of them was provided from Japan Productivity Centre (JPC) that plays a major role in promoting productivity in Japan's industrial society and in improving the quality of people's lives. It is supported by over 10,000 members. The other database is NIKKEI Almanac of small- and medium-sized companies. Two thousand revised standardised questionnaires were sent to researchers and development directors of companies listed in the databases mentioned above. Total number of 555 companies responded to which represents response rate of 27.75%. Out of these, 540 data sets were included into analysis. Out of included in the analysis samples, 503 provided valid answers for categorization of new product concept according to Booz-Allen and Hamilton (1982). Percentage of new to the world products is 27.6%, extent or new product line was concept of 35.0% of companies, and product modification was concept of 14.3%, repositioning in the market was 14.3% and cost reduction was concept of 8.7% of companies (Figure 6).

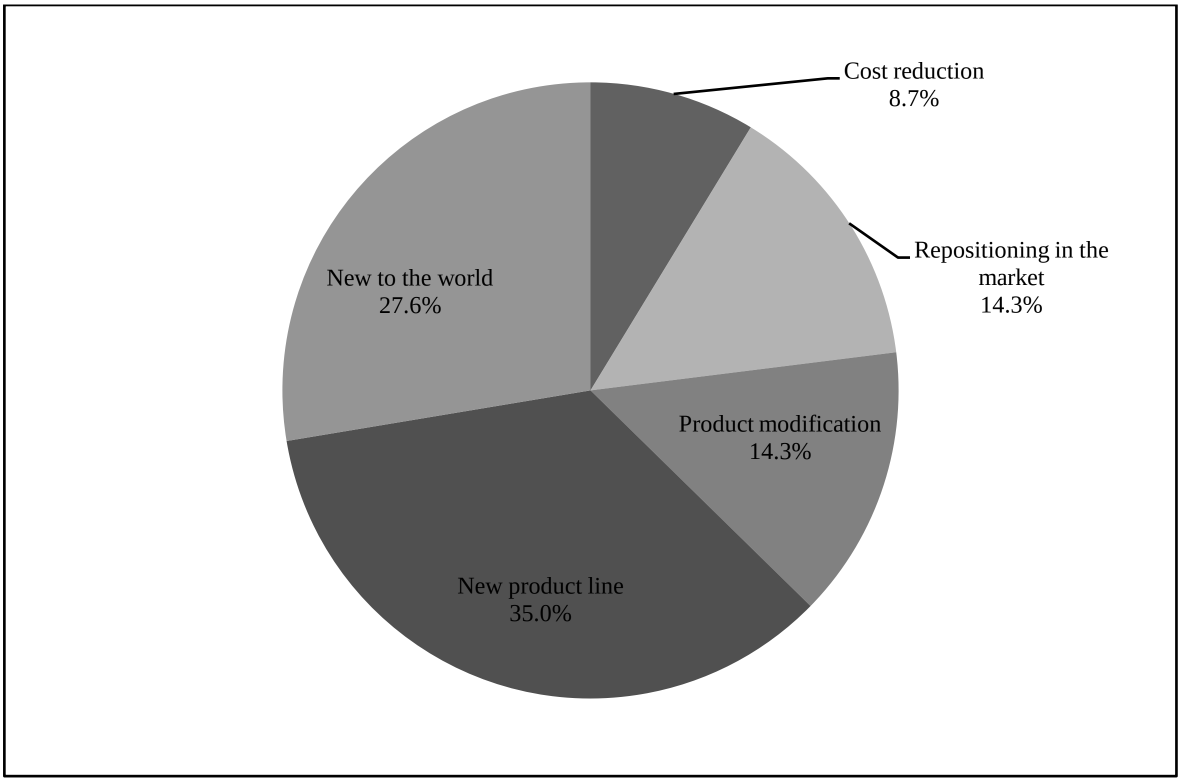

Figure 6. Categories of Japanese NPD projects. Source: Authors.

Authors report descriptive statistics about the 540 Japanese manufacturing companies that were analysed with SEM. As shown in Figure 7 and Figure 8, the Japanese manufacturing firms participating in this study had between one and 320,528 employees and annual sales ranging from five million JPY to 12,511,000 million JPY.

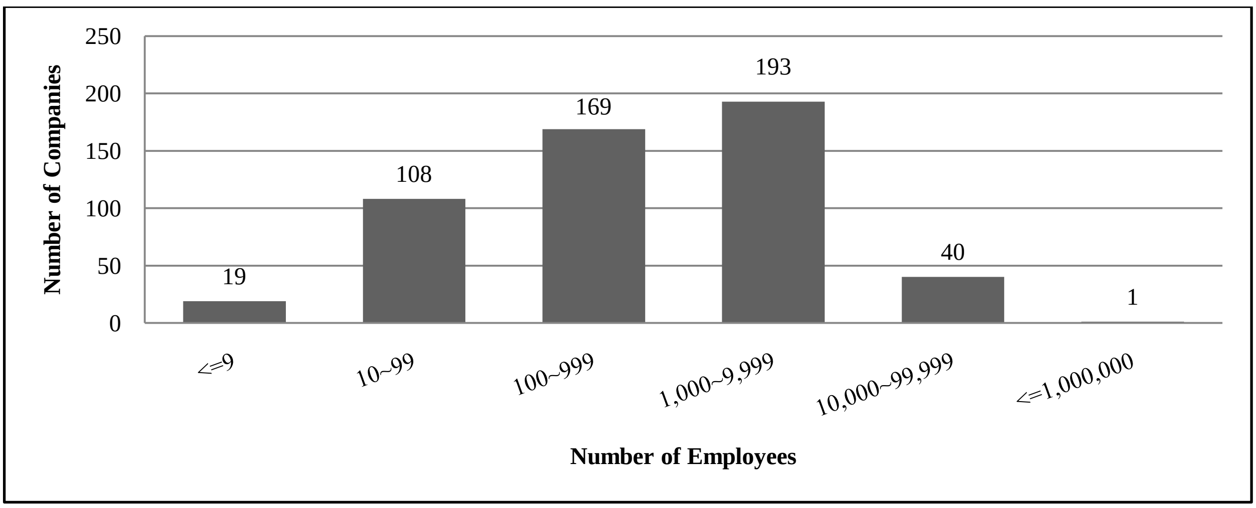

Figure 7. Number of employees (Japanese companies). Source: Authors.

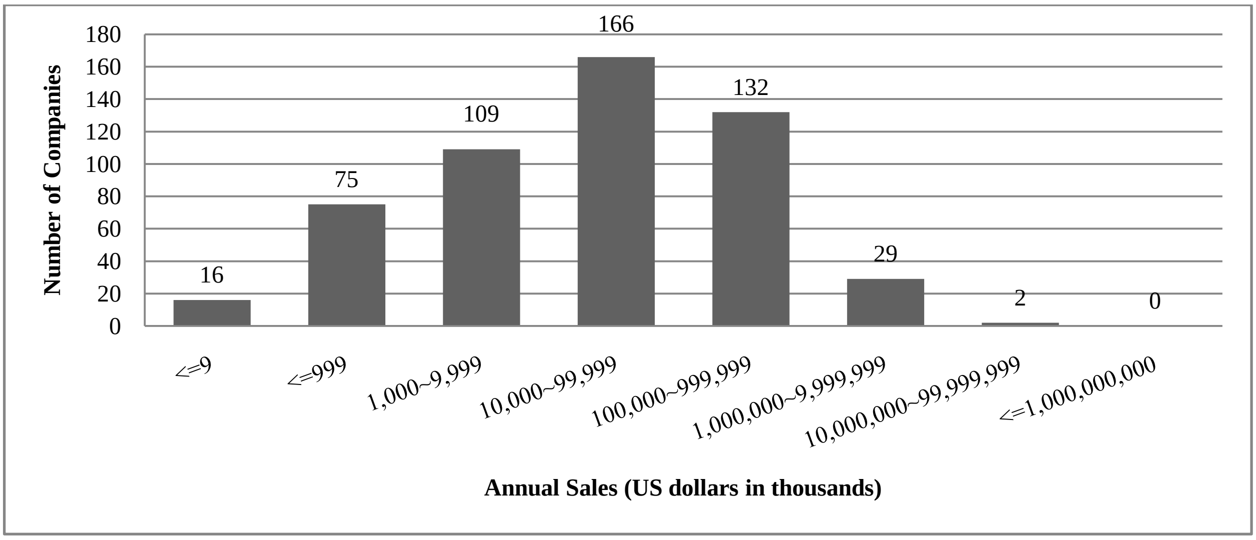

Figure 8. Annual sales (Japanese companies). Source: Authors.

Analytical Methodology

SmartPLS 2.0 (SEM) was used to analyse the data. Measurements validation was checked by calculating the traditional reliability of the measures, items with a low item to factor loading will be deleted, and Cronbach's alpha of each factor was calculated. The modification of factors was done and as soon as all factors show sufficient reliability, the factors were integrated into a measurement model and tested with SmartPLS 2.0. SmartPLS 2.0 does not account for any distribution, thus bootstrapping resampling technique was used to get *t*-values (Efron & Tibshirani, 1993).

Korean NPD Projects Analyses Results

Common criteria to evaluate reflective measures of PLS path models are the average variance extracted, the composite reliability, and communality (Stone-Geissers Q2) (Chin, 1998). The results of these calculations are shown in Table 1. The common quality requirements were met by almost each of the constructs. The path relationships (standardized regression coefficients) of the model were estimated performing SmartPLS 2.0. The bootstrap procedure (Efron, 1979; Diaconis & Efron, 1983) was used to obtain *t*-statistics in order to evaluate the significance of the parameters. The bootstrap sample means match with the original sample estimates. The validity of the model for Korean firms was tested and presented in Table 1. The common quality requirements are met by almost each of the constructs.

Table 1

Measurement Assessment (Calculation With SmartPLS)

	Average variance extracted > 0.5	Composite reliability > 0.7	Cronbachs alpha > 0.7	Stone-Geissers Q2 (communality) > 0
Degree of newness of NPD projects	0.38355	0.870375	0.836451	0.383554
Effectiveness	0.72274	0.928693	0.90401	0.722744
Efficiency	0.64295	0.843373	0.727951	0.642949
Intensity of planning	0.6677	0.909302	0.874935	0.667697
Project execution	0.33104	0.774108	0.661325	0.331035
Reduction of market uncertainty	0.5509	0.879698	0.835298	0.550903
Reduction of technical uncertainty	0.71641	0.926523	0.900774	0.716406

Figure 9 presents standardized path coefficient estimates for proposed relationships of conceptual model. These results provide empirical support for 10 of 20 hypotheses.

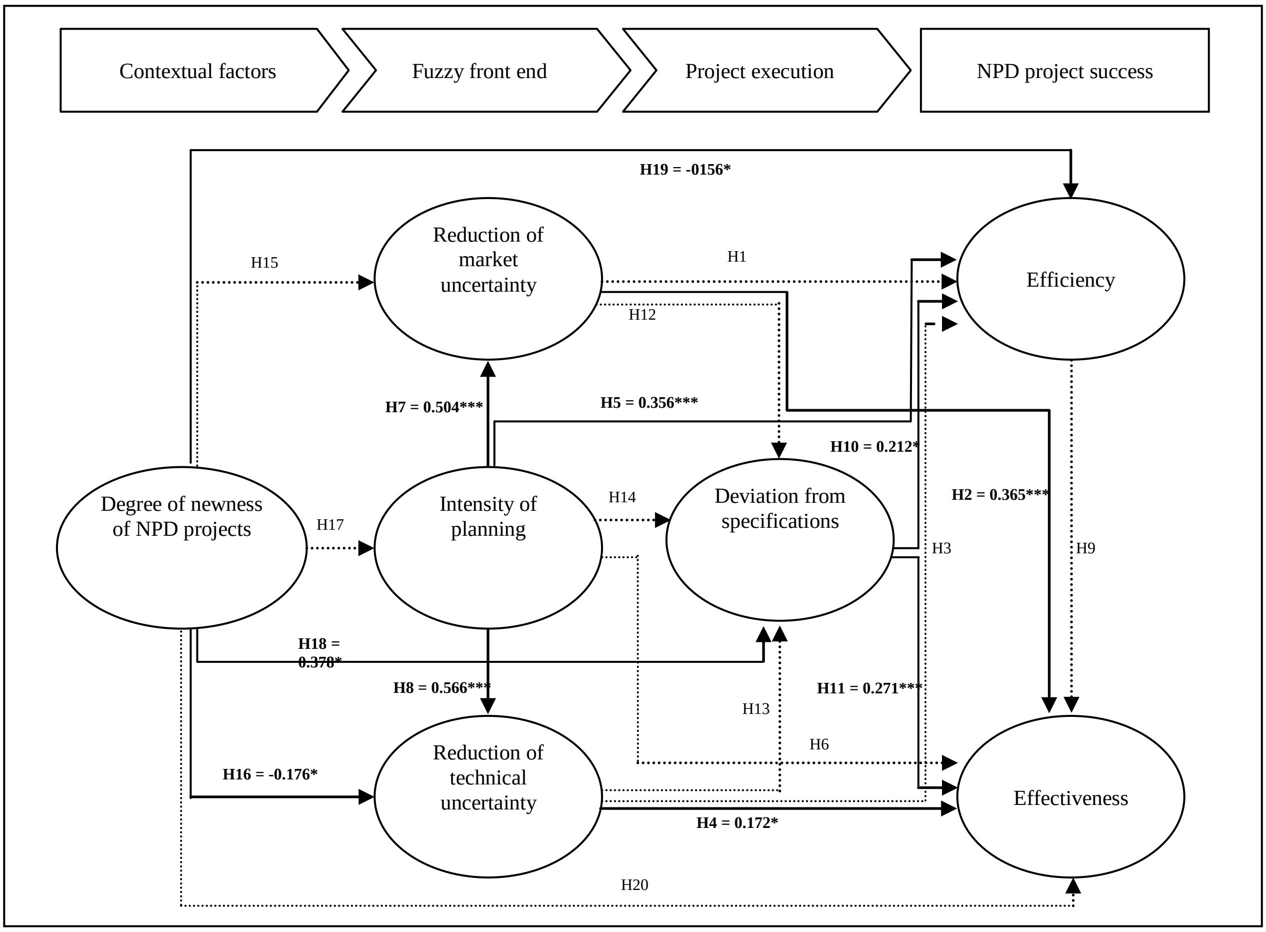

Figure 9. Results of SEM analyses (calculation with SmartPLS 2.0) (Korean NPD projects). Source: Authors.

Japanese NPD Projects Analyses Results

The validity of the model for Japanese firms was tested and presented in Table 2. The common quality requirements are met by almost each of the constructs. Figure 10 presents standardized path coefficient estimates for proposed relationships of conceptual model. These results provide empirical support for 11 of 20 hypotheses.

Table 2

Measurement Assessment (Calculation With SmartPLS 2.0) (Japanese NPD Projects)

	Average variance extracted > 0.6	Composite reliability > 0.7	Cronbachs alpha > 0.7	Stone-Geissers Q2 (communality) > 0
Degree of newness of NPD projects	0.3605	0.856275	0.840501	0.360499
Effectiveness	0.65281	0.903643	0.866905	0.652814
Efficiency	0.62319	0.83224	0.714572	0.623187
Intensity of planning	0.54326	0.855654	0.790431	0.543258
Project execution	0.27888	0.693349	0.626019	0.278878
Reduction of market uncertainty	0.54271	0.875773	0.829476	0.542711
Reduction of technical uncertainty	0.61442	0.888328	0.843265	0.614422

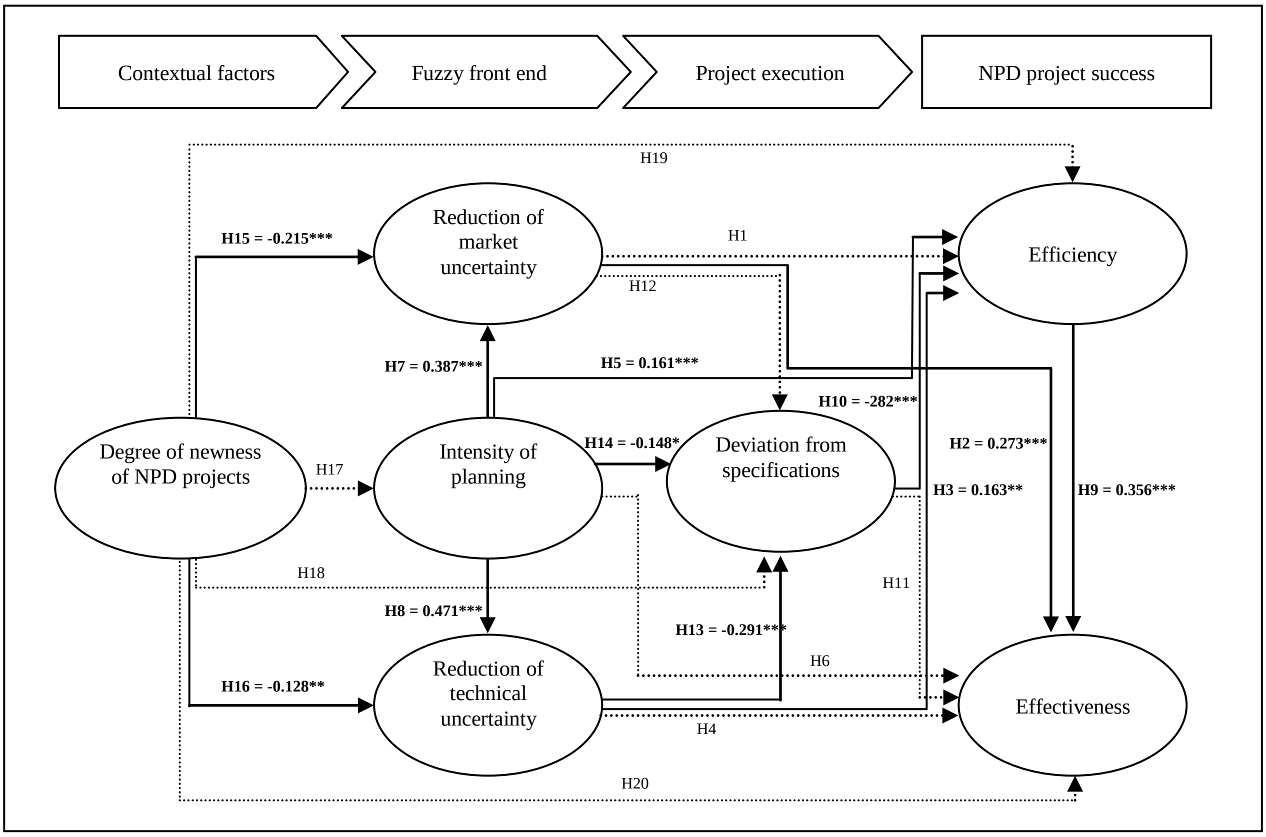

Figure 10. Results of SEM analyses (calculation with SmartPLS 2.0) (Japanese NPD projects). Source: Authors.

Discussion

Considering the results, it can be seen that five hypotheses (hypothesis 2, 5, 7, 8, and 16) were supported for both Korean and Japanese firms. For both countries, direct effects of FFE factors—reduction of market uncertainties and intensity of planning—have a strong positive impact on effectiveness and efficiency respectively (hypotheses 2 and 5), as a result, it has a positive role on success of NPD project. Besides the hypotheses 7 and 8 which indicate the relationship within the factors of FFE—intensity of planning with reduction of market uncertainty and reduction of technical uncertainty, which supports works in previous research was supported. Moreover, the hypothesis 16, which refers to the relationship between the degree of newness of NPD projects and reduction of technical uncertainty, is supported for both countries which can be explained by difficulty of reduction of technical uncertainties in case of high degree of newness of NPD project; these findings are also supporting the works in previous research.

On the contrary, five hypotheses (hypothesis 1, 6, 12, 17, and 20) were rejected for both countries' firms. According to the empirical results obtained, the level of degree of newness of NPD project and level of intensity of planning were not proved to be significant to affect the effectiveness for both countries (hypotheses 20 and 6). At the same time, in both countries, the effect of reduction of market uncertainty factor was not proved to be significantly affecting the efficiency (hypothesis 1), where efficiency is one of the NPD project success factors itself. Moreover, according to the empirical results, effects of degree of newness of NPD project and quality of reduction of market uncertainties were not proved to be significantly affecting intensity of planning prior to the development and project execution phase respectively (hypotheses 17 and 12).

Three hypotheses (hypothesis 4, 18, and 19) were rejected for Japanese firms, while they were supported with one star (*) for Korean firms. Besides hypothesis 11, relationship between project execution phase and effectiveness was rejected for Japanese firms, while it was strongly supported by three stars (***) for Korean firms. On the contrary, five hypotheses (hypothesis 3, 9, 13, 14, and 15) were supported for Japanese firms, while they were rejected for Korean firms.

Hypothesis 10—relationship between project execution phase and efficiency, was supported for both countries. It shows positive correlation coefficient for Korean manufacturing firms, while correlation coefficient is negative for Japanese firms, i.e., deviation from specifications effects positively efficiency of Korean firms, while efficiency of Japanese firms is affected negatively by the deviations from specifications in project execution phase.

Conclusions

In this study, authors analysed the impact of FFE on Korean and Japanese NPD project success considering data of two countries in the same geographic region but in different yet both successful time periods. According to the empirical results, in both countries, the effect of intensity of planning on efficiency, prior to the development was high. Moreover, effect of market uncertainties on effectiveness in both countries was significant. Thus, the statement in previous works that effective initial planning and good analysis of market prior to the development have positive impacts on NPD project success is supported.

Empirical results provide information that the negative correlation of degree of newness of NPD projects with FFE factors—reduction of market uncertainty and reduction of technical uncertainty in Japanese companies, was strong. Thus, it supports the hypothesis that the degree of newness of NPD project had a negative impact on FFE activities. Moreover, the effort spent on effective planning had a negative impact on deviations from specifications, while the deviations from specifications resulted negatively on efficiency of NPD project success in Japanese firms. In the late 80s, in the period of stability of the economy in the world, the Japanese firms were successful concentrating more on FFE activities, such as market and technological research and initial planning.

However, according to results, in Korean firms, the impact of intensity of planning was not proved to be significantly affecting project execution phase, while the impact of degree of newness of NPD project was proved to be significant. Moreover, it resulted in positive effects on efficiency and effectiveness. Thus, this paper concludes that in the late 2000s when the world started to change so fast and the demands for the goods change so fast, the Korean firms became more successful thanks to flexibility in the system of NPD project strategies where system was not fixed to the initial plans but where the changes within the project execution phase were allowed. It results positively on the NPD project as a whole where the main purpose of the project is to develop a new product.

To conclude, Korean and Japanese firms had different strategies in NPD process in these two different periods. Japanese firms were concentrated more on FFE activities and tended to keep initial plans during development process, while the Korean firms were more flexible in project execution phase allowing dramatic changes to the initial plans.

References

Backman, M., Börjesson, S., & Setterberg, S. (2007). Working with concepts in the fuzzy front end: Exploring the context for innovation for different types of concepts at Volvo Cars. *R&D Management, 38*(1), 17-28.

Booz-Allen & Hamilton. (1982). *New product management for the 1980s*. New York: Booz-Allen & Hamilton.

Brem, A., & Voigt, K. I. (2009). Integration of market pull and technology push in the corporate front end and innovation management—Insights from the German software industry. *Technovation, 29*(5), 351-367.

Brentani, U., & Reid, S. E. (2012). The fuzzy front-end of discontinuous innovation: Insights for research and management. *The Journal of Product Innovation Management, 29,* 70-87.

Chin, W. (1998). The partial least squares approach to structural equation modeling. In G. A. Marcoulides (Ed.), *Modern methods for business research* (pp. 295-336). Mahwah, NJ: Lawrence Erlbaum Associates.

Cooper, R. G. (1988). Predevelopment activities determine new product success. *Industrial Marketing Management, 17*(3), 237-247.

Cooper, R. G., & Kleinschmidt, E. J. (1987). What makes a new product a winner: Success factors at the project level. *R&D Management, 17*(3), 175-189.

Cooper, R. G., & Kleinschmidt, E. J. (1994). Screening new products for potential winners. *IEEE Transactions Engineering Management, 22*(4), 24-30.

Diaconis, P., & Efron, B. (1983). Computer-intensive methods in statistics. *Scientific American, 248,* 96-108.

Dvir, D., & Lechler, T. (2004). Plans are nothing, changing plans is everything: The impact of changes on project success. *Research Policy, 33*(1), 1-15.

Efron, B. (1979). Bootstrap methods: Another look at the Jackknife. *Annals of Statistics, 7,* 1-26.

Efron, B., & Tibshirani, R. J. (1993). *An introduction to bootstrap*. New York: Chapman and Hall.

Ernst, H. (2001). *Erfolgsfaktoren neuer Produkte: Grundlagen für eine valide empirische Forschung*. Wiesbaden: Deutscher Universitäts-Verlag.

Frishammar, J., Floren, H., & Wincent, J. (2011). Beyond managing uncertainty: Insights from studying equivocality in the fuzzy front end of product and process innovation projects. *IEEE Transactions on Engineering Management, 58*(3), 551-563.

Fukuchi, A. (2010). South Korea’s export competitiveness: Critical to overcoming the global crisis and issues going forward. *Economic Review, 5,* 2.

Galbraith, J. (1973). *Designing complex organizations.* Reading, MA: Addison-Wesley.

Griffin, A. (1997). PDMA research on new product development practices. *Journal of Product Innovation Management, 14*(6), 429-458.

Gupta, A. K., & Wilemon, D. L. (1990). Accelerating the development of technology-based new products. *California Management Review, 32*(2), 24-44.

Hauschildt, J. (1991). Zur Messung des Innovationserfolges. *Zeitschrift fu ̈r Betriebswirtschaft, 61,* 451-476.

Herstatt, C., Verworn, B., & Nagahira, N. (2004). Reducing project related uncertainty in the “fuzzy front end” of innovation: A comparison of German and Japanese product innovation project. *Journal of Product Development, 1*(1), 43-65.

Ho, Y. C., & Tsai, C. T. (2011). Front end of innovation of high technology industries: The moderating effect of front-end fuzziness. *Journal of High Technology Management Research, 22,* 47-58.

Jarvis, C. B., MacKenzie, S. B., & Podsakoff, P. M. (2003). A critical review of construct indicators and measurement model misspecification in marketing and consumer research. *Journal of Consumer Research, 30*(2), 199-218.

Khurana, A., & Rosenthal, S. R. (1997). Integrating the fuzzy front end of new product development. *Sloan Management Review, 38*(2), 103-120.

Khurana, A., & Rosenthal, S. R. (1998). Towards holistic “front ends” in new product development. *Journal of Product Innovation Management, 15*(1), 57-74.

Kim, J., & Wilemon, D. (2002). Focusing the fuzzy front-end in new product development. *R&D Management, 32*(4), 269-279.

Lynn, G. S., Reilly, R. R., & Akgun, A. E. (2000). Knowledge management in new product teams: Practices and outcomes. *IEEE Transactions on Engineering Management, 47*(2), 221-231.

Maidique, M. A., & Zirger, B. J. (1984). A study of success and failure in product innovation. *IEEE Transactions on Engineering Management, EM-31*(4), 192-203.

Moenaert, R. K., De Meyer, A., Souder, W. E., & Deschoolmeester, D. (1995). R&D/Marketing communication during the fuzzy front-end. *IEEE Transactions on Engineering Management, 42*(3), 243-258.

Moenaert, R. K., Deschoolmeester, D., De Meyer, A., & Souder, W. E. (1992). Information styles of marketing and R&D personnel during technological product innovation projects. *R&D Management, 22*(1), 21-39.

Murphy, S. A., & Kumar, V. (1997). The front end of new product development: A Canadian survey. *R&D Management, 27*(1), 5-16.

Oh, J., Yang, J., & Lee, S. (2012). Managing uncertainty to improve decision-making in NPD portfolio management with a fuzzy expert system. *Expert Systems With Applications, 39*(10), 9868-9885.

Peter, J. P. (1979). Reliability: A review of psychometric basics and recent marketing practices. *Journal of Marketing Research, 16*(1), 6-17.

Pinto, J. K., & Slevin, D. P. (1988). Project success: Definitions and measurement techniques. *Project Management Journal, 19*(1), 67-72.

Rubenstein, A. H., Chakrabarti, A. K., & O'Keefe, R. D. (1976). Factors influencing innovation success at the project level. *Research Management, 19*, 15-20.

Schweitzer, F., & Gabriel, I. (2012). Action at the front end of innovation. *International Journal of Innovation Management, 16*(6), 123.

Shenhar, A. J., Tishler, A., Dvir, D., Lipovetsky, S., & Lechler, T. (2002). Refining the search for project success factors: A multivariate typological approach. *R&D Management, 32*(2), 111-126.

Smith, P. G., & Reinertsen, D. G. (1991). *Developing products in half the time*. New York: Van Nostrand Reinhold.

Song, X. M., & Montoya-Weiss, M. M. (1998). Critical development activities for really new versus incremental products. *Journal of Product Innovation Management, 15*(1), 124-135.

Song, X. M., & Parry, M. E. (1996). What separates Japanese new product winners from losers. *Journal of Product Innovation Management, 13*(5), 422-439.

Song, X. M., & Parry, M. E. (1997a). A cross-national comparative study of new product development processes: Japan and the United States. *Journal of Marketing, 61*(2), 1-18.

Song, X. M., & Parry, M. E. (1997b). The determinants of Japanese new product successes. *Journal of Marketing Research, 34*(1), 64-76.

Verganti, R. (1999). Planned flexibility: Linking anticipation and reaction in product development projects. *Journal of Product Innovation Management, 16*(4), 363-376.

Verworn, B. (2009). A structural equation model of the impact of the "fuzzy front end" on the success of new product development. *Research Policy, 38*(10), 1571-1581.

Verworn, B., Herstatt, C., & Nagahira, A. (2008). The fuzzy front end of Japanese new product development projects: Impact on success and differences between incremental and radical projects. *R&D Management, 38*(1), 1-19.