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韓国製造業と日本製造業の Fuzzy Front End Innovation の比較研究

○長平彰夫（東北大学）

1 Introduction

Currently, Korean manufacturing companies such as SAMSUNG, LG Electronics, Hyundai Motors, Hynix Semiconductor, have been enjoying considerable success leading the world market in many different product fields. Therefore, there is great interest in 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 also called "fuzzy front end (FFE)" and I assume that this also plays a role in explaining the success of Korean and Japanese 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 termination (Murphy and Kumar, 1997). Khurana and Rosenthal (1998) define front end activities to include idea generation, market analysis, technology appraisal, identifications of customer needs and market segments, competitive situations, techno1ogy evaluation of current capabilities and requirements, the alignment with existing business and technology plans, and identification of core product requirements. As shown in **Figure 1**, I define that the FFE includes the very first activities within the NPD process (Phase I and II), and delivers a list of specifications.

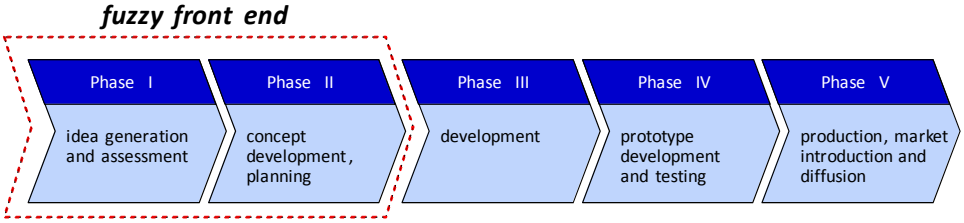

Figure 1 Definition of the fuzzy front end during NPD process

The aim of this study therefore is to reveal the impact of FFE activities on NPD product success of Korean and Japanese companies. Furthermore, I clarify the factors of the competitive advantages of manufacturing companies by comparing the FFE activities between Korean and Japanese manufacturers' NPD success.

2 Conceptual model

2.1. Development of the model

In order to describe their interrelationships in the section, I draw upon the literature about success factors, the FFE, and recent reviews of the NPD literature for guidance in developing a conceptual model. According to Lynn and Akgun (1998), uncertainties inherent in NPD projects relate to the market and technology. To compare the FFE activities of Korean NPD projects with Japanese NPD projects, the hypotheses about the relationships between the model factors are based on Verworn et al. (2008) (**Figure 2**).

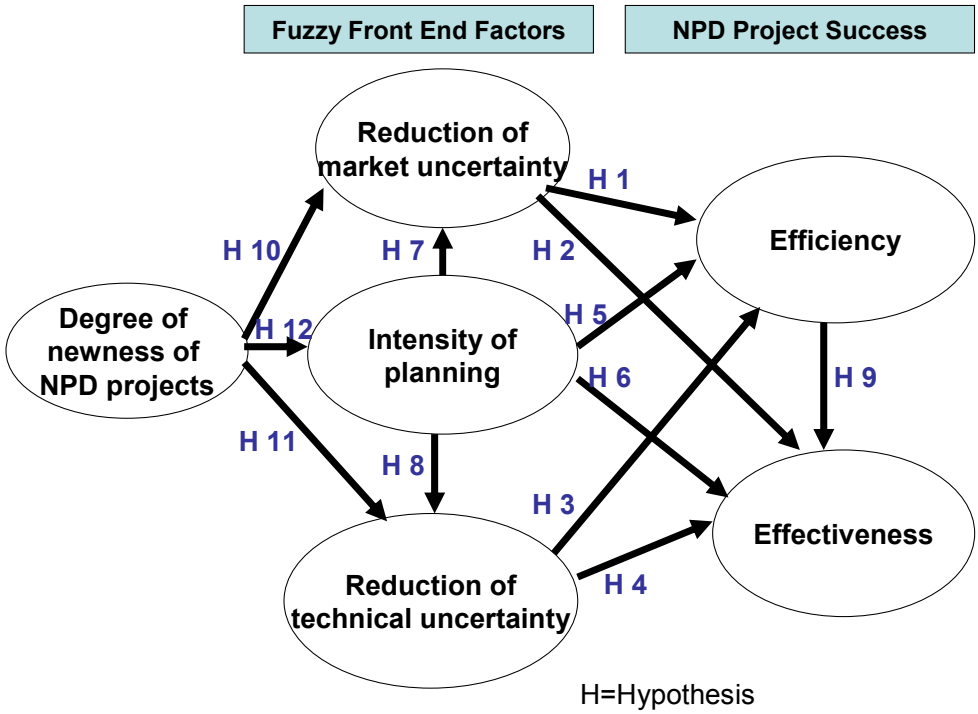

Figure 2 Hypothesized relations between front end factors and NPD project success

2.2. Hypotheses and measures

The model proposes three key front end factors that determine NPD project efficiency and effectiveness. The three factors of the model are "reduction of market uncertainty," "reduction of technical uncertainty," and "intensity of planning" before its development. Literature has identified the degree of newness of a NPD project for a firm as being a key contextual factor (Griffin, 1997; Khurana and Rosenthal, 1998; Moenaert et al., 1995; Tidd and Bodley, 2002; Verworn, 2009).

The factor "reduction of market uncertainty," in the model, refers to knowledge about customers' needs and wants, price sensitivity, and market attractiveness before development. The items were taken from previous study's of "marketing proficiency" (Song and Parry, 1997a; Boeddrich, 2004) and "proficiency in the business and market opportunity analysis stage" (Song and Parry, 1997b), focusing on market-related items relevant at the fuzzy front phases.

I used two factors for NPD success at the project level: "Efficiency" and "Effectiveness." For determining the efficiency, respondents assessed the degree of agreement between financial and personnel resources planned during the FFE and those actually required. In addition, respondents also evaluated the accordance of NPD with pre-determined milestones (Dvir and Lechler, 2004). "Effectiveness" evaluates project's outcomes such as meeting profit targets, sales volume targets, market share targets, customer satisfaction, and competitive advantages achieved by the NPD projects from the point of view of different stakeholders. I propose a positive link between the reduction of market uncertainty and NPD project success. As shown in **Figure 2**, I set up the following hypotheses.

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.*
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 of technical uncertainty during the FFE.*
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.*

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

Hypothesis10: *The high degree of newness makes it more difficult to reduce market uncertainty during the FFE.*

Hypothesis 11: *The high degree of newness makes it more difficult to reduce technical uncertainty during the FFE.*

Hypothesis 12: *The initial project planning differs according to the degree of newness of NPD projects.*

3 Research method

3.1. Data collection Policy

In order to compare the data of Korean and Japanese companies, it is necessary to collect data with same external conditions which surround a company. Economic circumstances have a strong impact on a NPD success, and per capita GDP affects the concept of NPD projects such as price and quality. Therefore, I observed economic performance and per capita GDP as indices representing external impact. Consequently, to reveal the impact of FFE activities on NPD product success, I need to collect the data about FFE activities of the "golden age" of Korea and Japanese firms.

3.2. Korean Data collection procedure

The sample of this study is 1,650 companies, which consist of 418 companies, mostly manufacturing, listed on KOSPI, 242 emerging companies with turnover of 900 million US dollars, 936 small and medium sized innovative tech-focused companies with turnover of greater than 90 million US dollars, and other small and medium sized companies. From these a total of 301 companies responded, a recovery of 18.2%, and 293 samples were included in the analysis with the exception of 8 samples due to their missing values. I used the 7-point Likert-type scales ranging from 1=*strong disagree* to *7=strong agree* and *1=objectives not achieved* to *7=objectives exceeded*.

3.3. Japanese Data collection procedure

For data collection of Japanese NPD projects, two corporate databases were used. The first was provided from the Japan Productivity Centre for Socio-Economic Development (JPC-SED). The other database is the NIKKEI Almanac of Small and Medium-Sized Companies. Out of 2000 questionnaires, 555 were returned, which represents a response rate of 28%. Of them, 540 of these data sets were valid for the analysis.

4 Results and discussion

4.1. Korean NPD projects

Figure 3 presents standardized path coefficient estimates for the proposed relationships of the conceptual model presented in **Figure 2**. These results provided empirical support for 6 of the 12 hypotheses. The positive impact of the reduction of market uncertainty on project effectiveness supported **hypothesis 2**. Contrary to the predictions, a positive impact on project efficiency as proposed by **hypothesis 1** was not found. **Hypothesis 3 and 4**, which describe the positive effect of the reduction of technical uncertainty on project success, were rejected by the path coefficients. The intensity of planning before the start of development had the positive effect (+0.373) on efficiency (**hypothesis 5**).However, there was no positive effect on effectiveness (**hypothesis 6**).The positive effects of the intensity of planning on the reduction of uncertainties during the FFE were the strongest direct effects in the analysis with +0.477 for market uncertainty (**hypothesis 7**) and +0.538 for technical uncertainty (**hypothesis 8**).

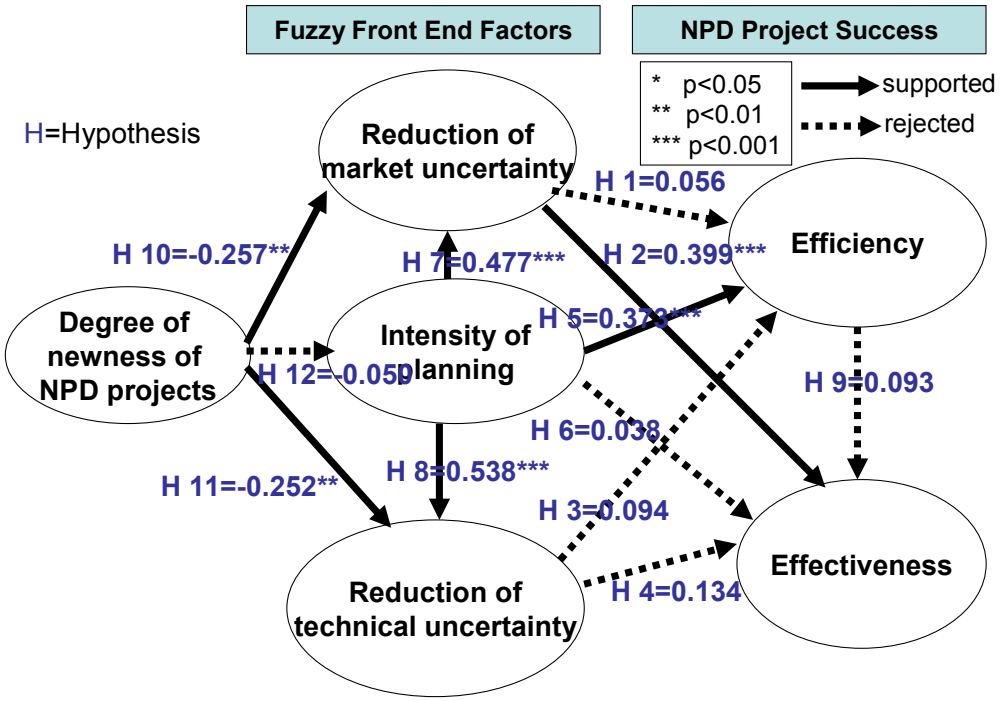

Figure 3 Results of the SEM analysis (calculation with SmartPLS 2.0) (Korean NPD projects)

Contrary to the previous research (Verworn et al., 2008), the effectiveness of NPD projects was not positively affected by NPD efficiency (+0.093) and **hypothesis 9** was rejected. Subsequently, I tested the three hypotheses concerning the effects of the degree of newness on the reduction of market uncertainty, the reduction of technical uncertainty, and the intensity of planning during the FFE of NPD projects. The degree of newness made it difficult to reduce uncertainties during the FFE. Thus, **hypothesis 10 and 11** were supported. On the contrary, since no difference between initial planning during the FFE, according to the degree of newness of NPD projects was found, **hypothesis 12** was rejected.

As a result, I revealed Korean manufacturing companies were much more focusing on the reduction of market uncertainty than the reduction of technical uncertainty when they developed new products in order to achieve high companies' performances such as sales volume, profit, and market share.

4.2. Japanese NPD projects

Figure 4 shows standardized path coefficient estimates for the proposed relationships of the conceptual model presented in **Figure 2** (compare with **Figure 3**). These results provided empirical support for 10 of the 12 hypotheses. The positive impact of the reduction of market uncertainty on project efficiency and effectiveness supported **hypothesis 1 and 2**. **Hypothesis 3** was supported by the path coefficient. On the contrary, **hypothesis 4**, which describes the positive effect of the reduction of technical uncertainty on project effectiveness, was rejected. The intensity of planning before the start of an NPD project had a positive effect (+0.199) on efficiency (**hypothesis 5**). However, there was no positive effect on effectiveness (**hypothesis 6**). The positive effects of the intensity of planning on the reduction of uncertainties during the FFE were the strongest direct effects in the analysis with +0.382 for market uncertainty (**hypothesis 7**) and +0.467 for technical uncertainty (**hypothesis 8**). In accordance with the previous research (Verworn et al., 2008), the effectiveness of NPD projects was positively affected by NPD efficiency (+0.384) and **hypothesis 9** was strongly supported. Subsequently, I tested the three hypotheses concerning the effect on the degree of newness on the reduction of market and technical uncertainty and the intensity of planning during the FFE of Japanese NPD projects. The high degree of newness made it difficult to reduce uncertainties during the FFE. Thus, **hypothesis 10 and 11** were supported. Moreover, since I found differences between initial planning

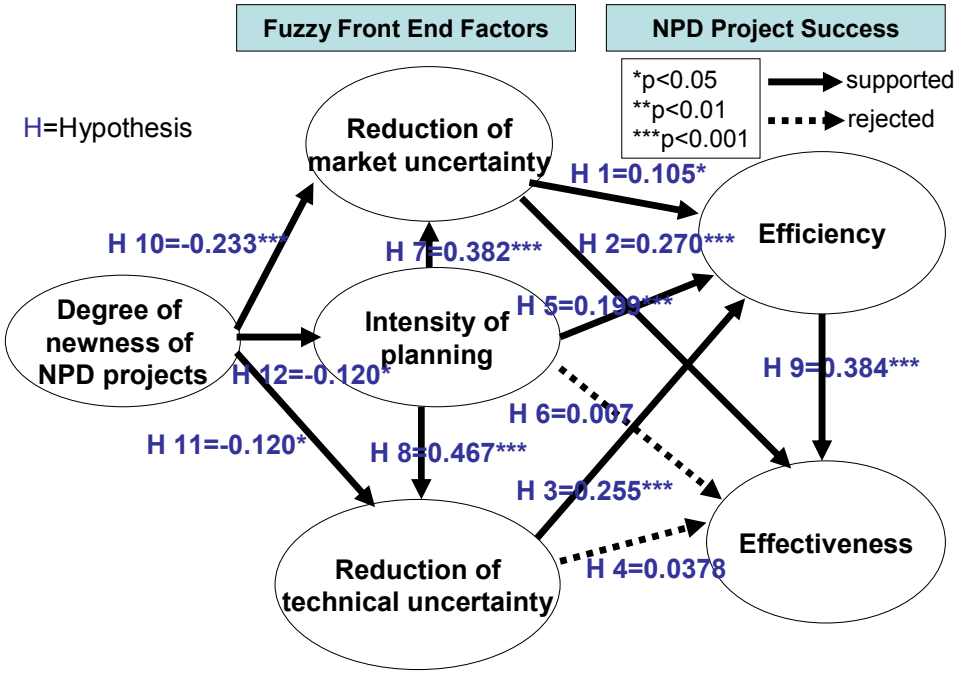

Figure 4 Results of the SEM analysis (calculation with SmartPLS 2.0) (Japanese NPD projects)

activities during the FFE, according to the degree of newness of NPD projects, **hypothesis 12** was supported.

4.3. Differences between Korean and Japanese NPD projects

Concerning Korean and Japanese NPD projects, the proposed model was basically supported. As shown in **Figure 3** and **Figure 4**, the number of supported hypotheses of **Figure 4** (Japanese NPD projects) was more than **Figure 3** (Korean NPD projects). However, when my attention was drawn to "reduction of market uncertainty" and "reduction of technical uncertainty" and I did find differences of their relationships between Korean and Japanese NPD projects. The positive effect of the "reduction of market uncertainty" on "Effectiveness" of **Figure 3** (+0.399) was stronger than **Figure 4** (+0.270).

When I look at the relationship, here between "Efficiency" and other latent variables of Japanese NPD projects, every **hypothesis (H1, H3, H5, and H9)** of proposed model was supported (**Figure 4**). On the contrary, as shown in **Figure 3**, every relationship between "Efficiency" and other latent variables of Korean NPD projects was rejected except for **hypothesis 5**. The **hypothesis 2** (Reduction of market uncertainty effect on Effectiveness) in Korean NPD projects was stronger positive effect (+0.399) than Japanese NPD projects (+0.270).

Korean companies' size seems to be relatively-smaller than Japanese firms. Therefore, one possible explanation for these results could be the other contextual factors' effects on the whole NPD process. Based on previous research (Verworn, 2009), I focused on one more contextual factor: "Company size". As for Korean reply firms, I selected the top 100 companies on the basis of the annual sales of companies. As shown in **Figure 5**, the analysis results with SmartPLS 2.0 indicate almost same between **Figure 4** (all Japanese firms) and **Figure 5** (Korean Top 100 firms) except "reduction of technical uncertainty".

5 Conclusions

Firstly, the critical key driver of project success was "the reduction of market uncertainty" before the start of development. Secondly, most of the proposed relationships between the intensity of planning and related factors were supported except **hypothesis 6** . Hence, "the intensity of planning" before the start of development was one of the key activities for project success.

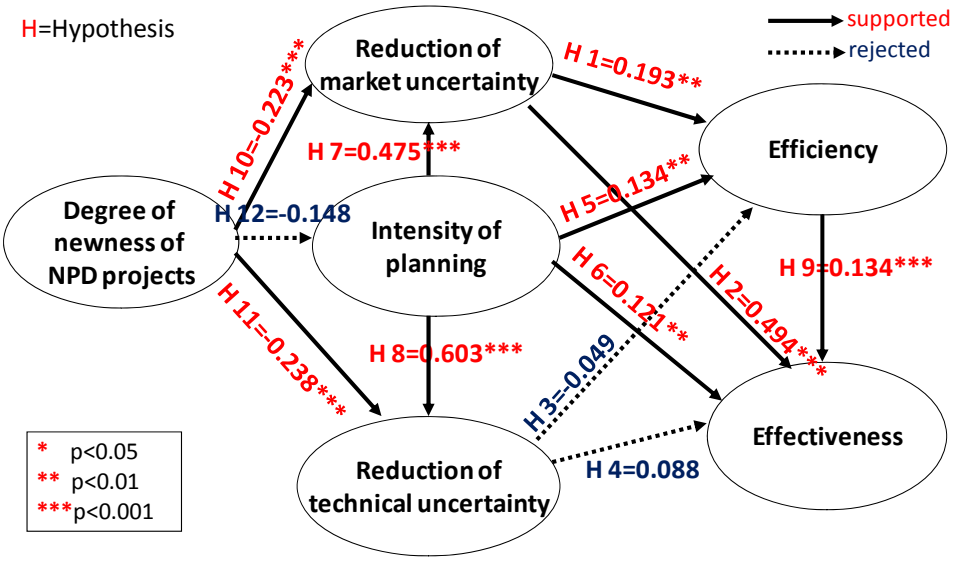

Figure 5 Results of the SEM analysis (calculation with SmartPLS 2.0) (Korean Top 100 companies' NPD projects)

On the contrary, "the reduction of technical uncertainty" had no positive effects on NPD project success except **hypothesis 3** in the analysis of Japanese NPD projects.

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