

# Entrepreneurial Orientation of Technology Spin-offs Created by University Faculties and Institute Researchers in Korea\*

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## ABSTRACT

This research focuses on entrepreneurial orientation(EO) of technology spin-offs as they are expected to reduce the gap between their technology and the market. Entrepreneurial orientation is an organizational activity or process that redistributes or combines resources in an innovative way and takes risk to create new values. It helps improve the level of organizational innovation to deal with uncertainty. An empirical study was performed to analyze the EO of spin-offs established by members of university faculties and research institutes in Korea. Antecedent variables to EO are hypothesized to include public policy for university faculty members and researchers at research institutes, the relationship with incubating organizations, and the level of social networking with other firms. The EO and technological performance relationships are also hypothesized. Data from a total of 121 spin-off organizations were collected and a series of multiple regressions were performed. The performance variable included both technological performance, such as the number of newly marketed products and new technology and subjective performance, such as the level of satisfaction with sales amount and profitability. Several important conclusions were drawn from this study. First, while government policy is not related to EO, the policy of a university or a research institute has a significant effect on the level of innovativeness. Second, a high percentage of human resources applied at the incubating organization results in a negative effect on risk taking. The level of cooperation with the incubating organization too is not related to Entrepreneurial Orientation. Third, the intensity of cooperative networking with other firms has a significant effect on risk-taking. Network relationship with government related organizations is not related to Entrepreneurial Orientation. This study analyzes the importance and role of policy of the university and research institute and networking with other firms to improve EO. It also suggests that a high composition of human resources at the incubating organization has a negative relationship with EO.

**Key word** : Technology Spin-off, University Incubation, Entrepreneurship

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## 1. INTRODUCTION

In the knowledge-based economy, the commercialization of research and development (R&D) has become the focus of interest for effective survival in a highly competitive environment. Of particular concern in this study is how the results of research at universities and public research institutes are transformed into economic values.

The commercialization of university research outcomes, which is beyond the traditional role of teaching and educating, has recently emerged as a critical issue. Despite that this change in the role of the university is controversial the need to support the commercialization of R&D results coming from university activities has increased sharply. Moreover, universities are now called upon to create national wealth in addition to providing human resources throughout society.

Two major types of such commercializing activities include the technology transfer and the creation of new start-up firms. Creating new start-ups as spin-offs of university research results in particular are becoming increasingly popular.

Entrepreneurship is said to be key to the success of any new start-up firm. Therefore, for better promotion of university spin-offs, providing an environment that facilitates the emergence of entrepreneurship is paramount to success.

Many entrepreneurship studies postulate a strong EO-performance relationship[9][5]. However, few empirical studies address antecedent factors of entrepreneurial orientation.

This study analyzes factors that facilitate entrepreneurial orientation (EO). More specifically, this research focuses on the precedents related to the entrepreneurship of university faculties and studies at research institutes. The two paramount research questions are:

- What are the organizational factors that lead to entrepreneurial orientation?
- What is the relationship between EO and technological performance?

## 2. SPIN-OFFS CREATED BY UNIVERSITY FACULTY MEMBERS AND RESEARCHERS AT RESEARCH INSTITUTES IN KOREA

Since the late 1990s, government supported research institutes(GRIs), small and medium enterprises(SMEs), and universities throughout Korea(The Republic of Korea) began playing a central role in research. Simultaneously, the government has promoted regional economies by utilizing technologies and human resources provided by universities and GRIs.

In Korea, GRIs, SMEs, and universities have been playing a central role since the late 90s. Mean while, the government has continued to promote the regional economy by utilizing the technologies and human resources provided by universities and GRIs.

The Korean government has legislated laws to promote and support universities that start businesses. By law, faculty members at universities are authorized to go on leave from the university for up to three years to engage in running a new company. The government also allows the registration of in-campus laboratory ventures as an independent business, which was not possible before. The new law on the establishment of technology holding companies has been in effect since 2007. This law set the foundation for university-based holding companies to begin investing in spin-offs.

According to official statistics published by the Small and Medium Business Administration in 2007, there are 846 faculty start-ups in Korea. Among them, sixteen companies are already listed on the KOSDAQ stock market. Three hundred, seventy-eight faculty members returned to their universities, of which 28% went bankrupt, another 28% transferred ownership, and 12% went into M&A. On the average, 47 new companies are created every year. Ninety-six people become involved in new start-up several year, while on the other hand, 49 people go back to the university annually. As for the location of start-ups, 42% are located in the university incubators, 29% in industrial parks, and 27% in laboratories.

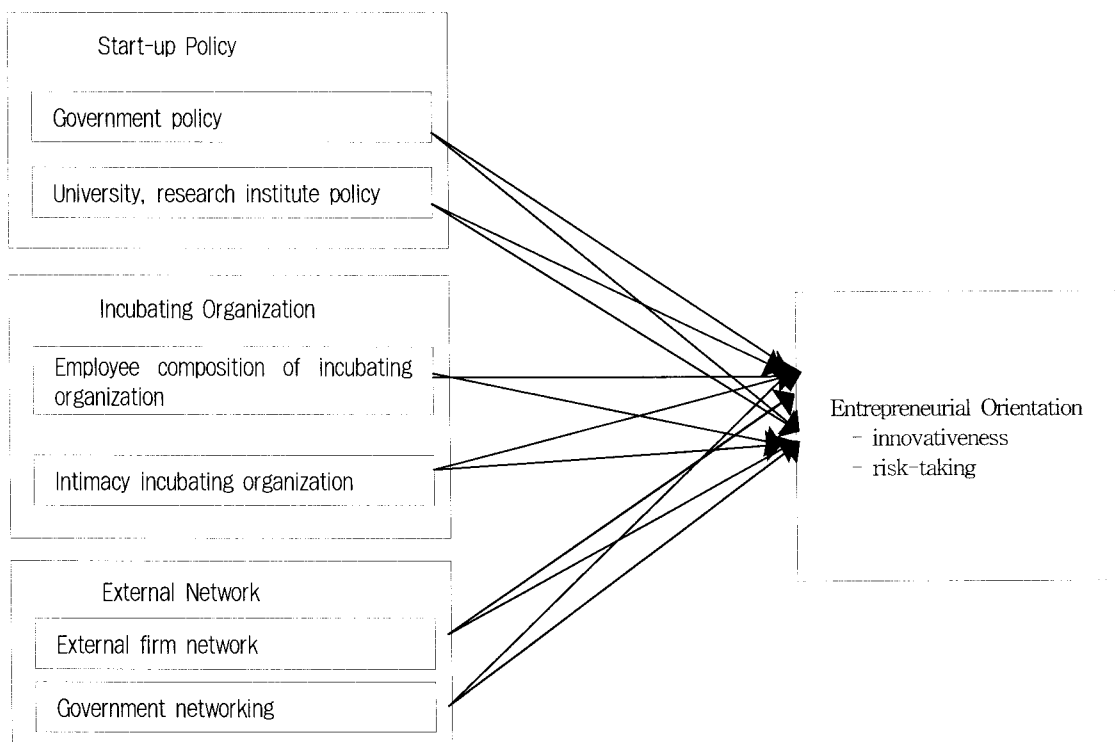
### 3. THEORETICAL BACKGROUND AND HYPOTHESIS

The entrepreneurship of university spin-offs transforms technological breakthroughs into commercial value. Despite the massive effort to realize the effects of university entrepreneurship through spin-offs, many universities face difficulties in facilitating the creation of spin-offs.

Entrepreneurial aspects such as opportunity identification, risk taking, and resource mobilization have been highlighted as critical success factors for academic spin-offs[10][12], where entrepreneurial behavior is believed to stimulate growth and economic performance. Entrepreneurship is regarded as crucial to bridging gaps between the research and business worlds[1]. Entrepreneurship is often said to exist in the firm that “engages in product market innovation, undertakes somewhat risky ventures and is first to come up with ‘proactive’ innovations, beating competitors to the punch”[8]. Most scholars tend to

agree with Miller that it is their EO, multidimensional construct encompassing firm innovativeness, pro-activeness and risk-taking. Innovativeness refers to the supportive tendency towards new ideas, novelty, experimentation, and creative process, while departing from established practice[6]. Pro-activeness is the propensity to anticipate and act on future market needs[6], while risk-taking is the willingness to commit large amounts of resources to projects characterized by highly uncertain outcomes[7]. The firms’ ability to seize and act on opportunities has positive performance implications, i.e. first mover advantage. In today’s uncertain environment, managerial support for risk-taking strategies has proven successful, especially in the long run[14].

This research analyzes the relationship between performance and the entrepreneurial orientation subject to the businesses created by university spin-offs and researchers among Korea’s innovative firms. At the same time, as preceding variables, how the entrepreneurial policy, incubator organization network



<Figure 1> Research Model

and other organization networking affect the entrepreneurial orientation and the market's orientation, and how the competitive environment of firms affect the entrepreneurial will be verified. <Figure 1>shows the research model.

### 3.1 Government and University Policies on Start-ups

The internal and external environments of companies, as well as the entrepreneurship, are important for the creation of a new start-up[13]. The characteristics of an environment related to the start-up, such as the institutional environment and industrial environment are said to be key precedents that affect the creation of spin-offs. The success of Silicon Valley in promoting new start-ups through favorable policy environment can be one good example.

The institutional environment includes the law and policy of government and various institutional mechanisms related to the start-up. Such supporting policy of government and universities also affect the growth of start-ups after their creation. Thus, the start-up policy of government and universities can be considered as an antecedent to the increase of entrepreneurial orientation. For this reason, the following hypothesis is suggested:

Hypothesis 1a: The start-up policy of government will be positively related to the level of innovativeness.

Hypothesis 1b: The start-up policy of universities will be positively related to the level of innovativeness.

Hypothesis 1c: The start-up policy of government will be positively related to the level of risk-taking.

Hypothesis 1d: The start-up policy of universities will be positively related to the level of risk-taking.

### 3.2 Relation with the Incubating Organization and the Composition of Employees from the Incubating Organization

Human resources equipped with highly specialized knowledge, skill, and ability is the major source of sustainable competitive advantage. The uniqueness of such resources cannot be easily imitated by competitors[2].

The growth of a company is determined by how the

initial resources fit to the characteristics of the institution and the market[5]. For example, the level of innovativeness of the initial members will determine the scope of growth opportunity. Members who came from a conservative incubating organization will be less responsive to the changes in the market.

In the case of a research-based spin-off company, because of the small size of the initial founding team, the role of the members from the incubating organization becomes an important determinant of business performance. An informal interview with selected spin-off founders revealed that one important factor that lead business failure is the level of conflict among team members from the incubating organization in an attempt to seize the power. Thus, a spin off with a large portion of members from an incubating organization can have a negative influence to the level of entrepreneur orientation.

Hypothesis 2a: Employee composition with a large portion of members from the incubating organization will be negatively related to the level of innovativeness.

Hypothesis 2b: The level of intimacy between spin-offs and the incubating organization will be negatively related to the level of innovativeness.

A close interaction with the technology-oriented incubating organization will provide rich information on the trend and potential of an emerging technology. For this reason the level of intimacy with the incubating organization will be positively related to the sensitivity of the spin-offs' technological development. Thus,

Hypothesis 2c: Employee composition with a large portion of members from the incubating organization will be negatively related to the level of risk-taking.

Hypothesis 2d: The level of intimacy between spin-offs and the incubating organization will be negatively related to the level of risk-taking.

### 3.3 External Networking with Other Companies and the Government

The core of EO is the continuous pursuit of opportunities. To realize opportunities new start-ups should be able to economize external resources as well as internal ones.

External networking, especially the size of the network, is closely related to the evolution of a new start-up. Fast growing start-ups tend to have a larger size of external network than others. Start-up company founders tend to acquire information about new products and services as well as important resources from external networking with other companies or the government.

It is reasonable to assume that the resource benefits of intense networking relationships are more vulnerable to new ventures when they are most vulnerable, i.e., at earlier development stages. Similar to the discussion of network range, organizational networks of high-growth entrepreneurial firms will have great intensity[15].

We hypothesize networks of other external firms and government as range of networking.

Hypothesis 3a: The size of an external network with other companies will be positively related to the level of innovativeness.

Hypothesis 3b: The size of networking with government will be positively related to the level of innovativeness.

Hypothesis 3c: The size of external networking with other companies will be positively related to the level of risk-taking.

Hypothesis 3d: The size of networking with government will be positively related to the level of risk-taking.

### 3.4 Entrepreneurial Orientation (EO) and Technology performance

Many entrepreneurship studies postulate a close relationship between EO and performance[9][3]. Such a relationship applied to general start-ups can also be extended to university spin-offs. In this vein, we consider that EO is critical to the growth of academic spin-offs. The commercialization of new technologies usually involves intense innovation[11]. Because new start-ups are not matured enough to be analyzed based on their business outcome, this research focuses on the level of technological performance.

Hypothesis 4a: The level of innovativeness is positively related to the number of products introduced

to the market.

Hypothesis 4b: The tendency toward risk-taking is positively related to the number of products introduced to the market.

Hypothesis 4c: The level of innovativeness is positively related to the amount of technology development.

Hypothesis 4d: The tendency toward risk-taking is positively related to the amount of technology development.

## 4. METHODOLOGY

### 4.1 Sample

Korean university spin-offs, including members of the Korean Business Incubation Association were surveyed to test the research hypotheses. Out of the total of 671 companies surveyed, 121 companies responded (18.4%).

The average age of the sample companies is six. About 65% of the sample has less than 10 employees. Over 40% of the companies belong to the electric, electronics, information, and telecommunications industries.

### 4.2 Antecedent variables

#### 4.2.1 Government's entrepreneurial policy

The government's entrepreneurial policy was categorized into fund/financial service, human resource support, export & marketing support, information system support, and tax reduction. Each service was measured on a five-point scale.

#### 4.2.2 University's entrepreneurial policy

Universities provide their own internal support services in compliance with the government's entrepreneurial policy. Among all them, two representative services were included in this research: the existence of a formal support center for entrepreneurship within the university and the provision of consulting services to start-up firms.

4.2.3 Employee composition in relation to the incubating organization

The percentage of employees transferred from the incubating organization in the start-up teams was calculated and used as a measure of employee composition.

4.2.4 Intimacy of incubator organization

The frequency of information exchange between the start-up teams and the corresponding university administrators was measured.

4.2.5 Network with other companies and government

The frequency of interaction between the start-up teams and other firms and government were measured.

4.3 Independent variable

Entrepreneurial orientation

In order to measure entrepreneurial orientation, the level of innovativeness and risk-taking were selected and measured[4].

4.4 Dependent variable.

The number of new products introduced to the market and the level of technology development were used as indicators of technological performance.

5. RESULTS

The effects of six antecedent variables were analyzed based on 121 responses using regression analysis. In other words, the effects of the government's entrepreneurial policy, the university's entrepreneurial policy, the human resources of incubator organizations, networking among incubator organizations, government and other firms were statistically analyzed.

Regression between entrepreneurial orientation and antecedent variables show a significant effect between the level of university support services and level of innovativeness. Therefore, hypothesis 1b is accepted.

On the other hand, the percentage of employees transferred from the incubating organization had a significant negative effect on the entrepreneurial orientation. Thus, hypothesis 2c is accepted. Finally, the intensity of networking with other firms show a significant effect with risk-taking.

<Table 1> Results from Multiple Regression Analyses on the Effects of Antecedent Factors on eo

Variable	Innovativeness	Risk-taking
Government's policy	-.148 (.107)	.087 (.346)
University's Policy	.252*** (.006)	-.063 (.482)
Human resources of incubator organization	-.041 (.668)	-.206** (.034)
Cooperation with incubator organization	.107 (.288)	-.131 (.194)
Cooperation with other firms	.121 (.329)	.292** (.020)
Cooperation with government	-.206* (.098)	-.021 (.865)

\*p<0.1, \*\*p<0.05, \*\*\*p<0.01

The regression analysis between entrepreneurial orientation and performance variables show a significant relationship between the level of technology development and the level of risk-taking. Therefore, hypothesis 4b is accepted.

<Table 2> Result of Regression Analyses on Performance Variables

Variable	Number of product	Level of technology development
Innovativeness	.104(.261)	0.191
Risk-taking	-.092(.323)	.196**(.033)-

\*p<0.1, \*\*p<0.05, \*\*\*p<0.01

6. DISCUSSION

This research focuses on entrepreneurial orientation (EO) of university spin-offs as it is expected to reduce the gap between their technology and the market. We derive four hypotheses that link perceptions of start-up founders on start-up policies, relationship with incubating organization, external networking and their relationship with Entrepreneurial Orientation (EO). Further, the relationship between EO and the performance was also analyzed. Implications from this

research can be summarized as below.

First, the policy of a university or a research institute has a significant effect on the level of innovativeness, while government policy is not related to EO. This result means that at the university or research institute, policy is more specific and relevant to the corresponding start-ups than the government's policy.

Second, a high percentage of human resource usage at the incubating organization has a negative effect on risk taking. The level of cooperation with the incubating organization also is not related to Entrepreneurial Orientation. This result is important because it may imply that employees from incubating organizations do not have enough experience in the field of market and thus avoid risk-taking.

Third, the intensity of cooperative networking with other firms has a significant positive effect on risk-taking. On the other hand, networking relationship with governmental institutes is not related to the level of Entrepreneurial Orientation. This result implies that improved understanding of the market situation obtained from cooperative business networking helps reduce uncertainty and thus facilitates risk taking.

Lastly, risk-taking has a significant effect on the level of technology development. A tendency toward high level risk-taking can incur an optimistic culture that encourages more experiments and trials, which is related to attempting a high level of technology development.

## 7. CONCLUSION

Studies of entrepreneurial orientation have focused on the relationship between entrepreneurial orientation and business performance. Relatively few studies examine the antecedent factors to entrepreneurial orientation. However, this study highlights the importance and role of policy at the university and research institute and networking with other firms as antecedents to EO.

The study proves the existence of a close relationship between university policy, business

networking and EO. Furthermore, people from external organizations other than the incubating organization can help spin-offs to overcome the bureaucracy.

Future research can divide government and university policies into sub-categories and analyze their effects on entrepreneurial orientation and business performance. In addition, the structure, duration, scope, and the formation process of business networks should be studied further to draw strategies that can effectively improve EO and performance. A composite analysis that includes all antecedent and ex post facto variables can also be performed.

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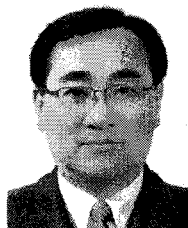
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