A STUDY ON THE GOVERNMENT STRATEGY FOR SPACE INDUSTRY ACTIVATION IN KOREA

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ABSTRACT

In this study, a business ecosystem of domestic space industry is comprehensively analysed to derive influence factors. Priority level of each element as well as the disparity between ideal and real scenario is investigated through literature review and expert survey. Three major influence factors determined contain: investment scale and approach, propulsion system, and finally, industrialization with overseas expansion. Related issues based on the current status are evaluated, followed by proposed activation strategies. Findings from the research offer a direction for research and development budget allocation on aerospace study and law system maintenance for the activation of space industry in Korea.

Keywords: space industry; space industry activation; influence factor; industry ecosystem; government R&D budget; vitalization strategy.

1 INTRODUCTION

1.1 Background and Objective

Space industry has enormous potentials to generate ripple effects over industry, economy, and technologies as well as new industry. Therefore, it is highly valued as the space industry can branch into diversity of new industries for next generation. However, insufficient critical technology and lack of industrial foundation have delayed advancement toward world market, making the space industry ecosystem feeble. In recent years, the government announced its intention to promote space industry actively and encouraged pre-development of the Korea Space Launch Vehicle beside other space industry as a part of national projects. Currently, it is considered as a turning point for the Korean space industry where budget and policy-related environments are under changes. It is significant to construct sustainable ecosystem and create pre-market in order to improve space industry continuously, and therefore, establishing efficient institutional support from the national and public sector is highly necessitated.

Various strategic methods have been proposed to vitalize space industry so far. Although many of the strategies exclude priority concept and some of them concern interests from specific classes. Applying such strategies could therefore be risky. This study aimed at deriving influence factors through analysing ecosystems of the Korea space industry, and suggesting the best strategy by considering priority among the measures for activation of space industry ecosystem.

1.2 Contents and Method

Ecosystem of space industry in Korea is broadly analysed to derive influence factors by considering budget flow. In order to deduct detailed influence factor, more specified investigation on overall space industry including satellites, projectile, and satellite information is suggested. Considering few limitations such as time, this study aims to draw prior promotive strategies for the activation of space industry at the same time. Based on the derived influence factors through broad investigation over the ecosystem, various factors obtained from literature review and expert interviews are thoroughly integrated.

Total 39 different influence factors come up through comprehensive survey on space industry, review on previous studies, and interviews from related experts. Significance on each influence factor and gaps between the ideal and real scenario are surveyed by asking 63 experts majoring in the field of space. Eight major influence factors having higher than mean significance and mean gap are deducted. The deducted influence factors are categorized into three major factors based on correlation analysis and qualitative evaluation. Three major factors contain scale and methods of budget investigation, promotive system of space development, introducing overseas market through industrialization of space technology. For each factor, critical trends and issues are examined and the results are supplemented to attain improvement plan besides experts' conference so that aerospace industry can be activated properly in Korea.

2 Comprehensive analyses on the ecosystem of space industry

In order for domestic space industry to be equipped with the ability to revive spontaneously, establishing sustainable industrial structure in terms of ecosystem is essential. Considering that space industry is government-oriented in Korea, analysis on budget flow is conducted so that the host of space industry and the correlation can be examined.

Figure 1 Flowchart of government budget on aerospace industry

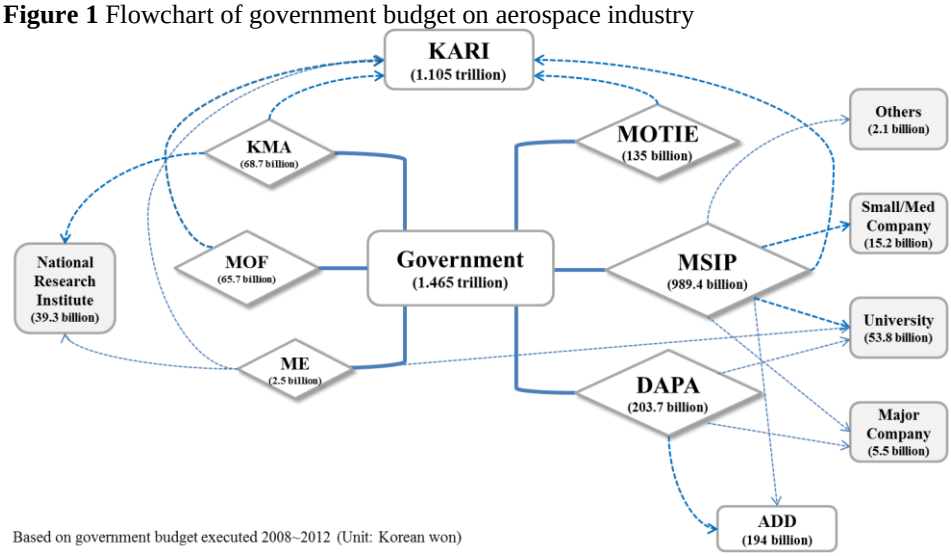


Figure 1 describes flowchart of government R&D budget on the field of space conducted during the year of 2008~2012 based on the national research institute where the chief institute belongs to. Among government ministry, the Ministry of Science, ICT and Future Planning is recognized as a major ministry taking 67.5% (989.4 billion won of 1.465 trillion won) of total government budget. Second and third major ministry are the Defense Acquisition Program Administration taking 13.9% (203.7 billion won) and the Ministry of Trade, Industry and Energy takes 9.2% (135 billion won) of total. Besides, the Korea Meteorological Administration, the Ministry of Oceans and Fisheries, and the Ministry of Environment are involved in procuring budget on developing geostationary orbit satellite as they participate in several parts of the space project.

Among national research institute, the Korea Aerospace Research Institute takes the most of domestic budget as it takes 92% of the MSIP budget in order to carry out both delegated and own business. Agency for Defense Development takes 95% of the DAPA budget to take charge of the aerospace research related to the national defense security. There are neither budget inputs from DAPA to KARI nor from MSIP to ADD. This suggests that cooperative research among two ministries and two institutes is not activated enough. In addition, the Korea Meteorological Satellite Center and other institutes take some part of the KMA budget. Rest of the KMA, MOF, and ME budget are mostly executed by KARI.

MSIP is responsible for 87% of the aerospace research-budget in Korean universities. The largest share of the budget is assigned to KAIST, Chungnam National University, Korea Aerospace University, Seoul National University, Hanyang University, and Yonsei University in that particular order. MSIP is responsible for 100% of the aerospace research-budget in small and medium companies. Participating companies are AP Aerospace Incorporated, i3System, Fiberpro, DACC, Justech ESD, Satrec initiative.

As above, the government budget flow on aerospace research is investigated to figure out the host of domestic space industry and its correlation. Three main factors interrupting the activation of space industry ecosystem are discussed as follows;

1 Aerospace research is highly dependent upon government investment. Naturally, it becomes hard to stand alone and susceptible to external variables. For instance, variations on governmental policy or budget directly affect space industry ecosystem, and therefore work as unstable factor. Worse, less private investors become willing to subsidize the research accordingly, which will finally hinder the construction of sound and stable industry ecosystem.

2 Role of each main research institute and relations between institutes are not clear. Under the aerospace researches conducted by MSIP and KARI, MSIP has trouble figuring out the technological demand over ministry and establishing long-term plan. Besides, there are limitations and inefficiency on classifying roles between industry and academia.

3 Preparation for secondary industry with highly added-value is still lagging behind far more than primary industry. In Korea, aerospace research is focused mostly on the development of technology, and then the

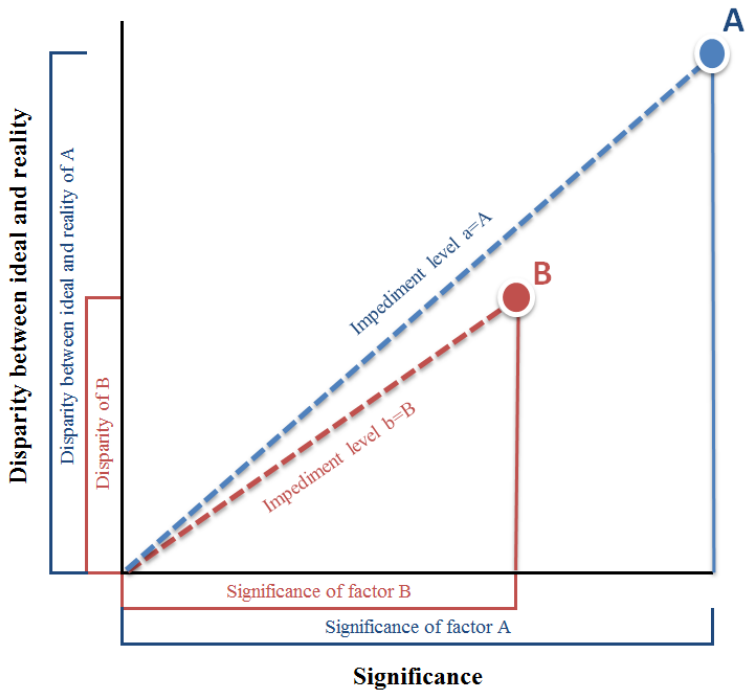
application after technological strategies of advanced country. As a result, most of the national R&D projects are concentrated on retaining large-scale aerospace devices, whereas enhancement of secondary industry through the application of such devices is incomplete.

3 Analysis on influence factors of space industry ecosystem

3.1 Selection and Evaluation of Influence Factors on Space Industry

In order to supplement the comprehensive analysis on domestic space industry, further factors are added based on existing researches of space policy and industrialization of space technology. Interviews from aerospace experts are also referred to complement additional influence factors. Each derived influence factor is classified into one of the following conditions founded on Porter's Diamond; factor conditions, demand conditions, related and supporting industries, firm strategy, structure and rivalry, government, and chance. The selected 39 influence factors are examined by 63 aerospace experts - 26 from industry, 17 from institution, and 14 from university - for further analyses. Significance of each factor and gaps between ideal and reality are described in next section. Impediment level is defined as the root sum of squared each gap. The higher the significance and gaps, the higher the influence factors that interrupt space industry ecosystem, meaning that numerous endeavors are needed in order to enhance current level of influence factors (see Figure 2). Once improved, it will considerably contribute to the activation of space industry ecosystem.

Figure 2 Impediment level



3.2 Analysis of Influence Factor

3.2.1 Factor Condition

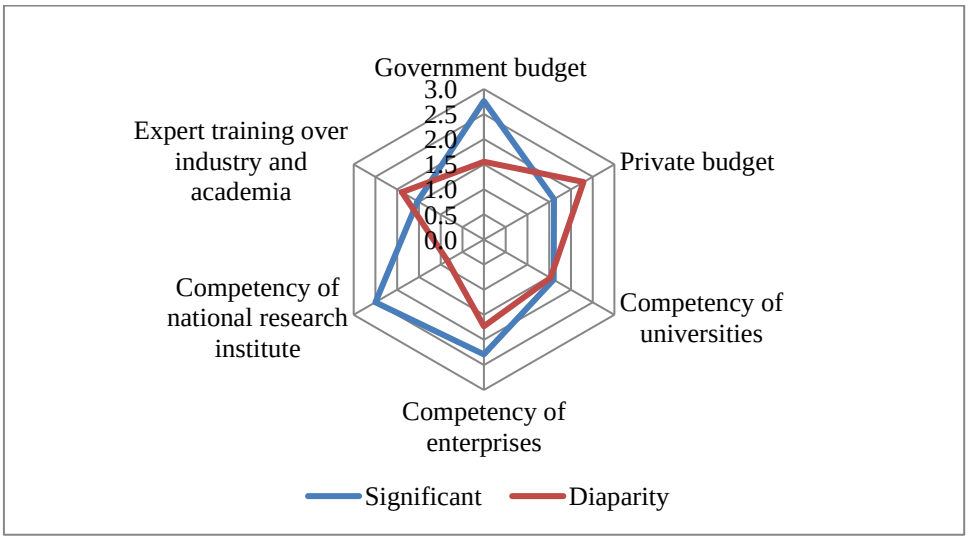
Factor condition signifies factors of production for competition including knowledge, financial affairs, social overhead capital as well as physical resource such as human resources, climate and location. In this part, conditional factors are considered as one of remarkable variations such as human, physical, and intellectual resources, and infrastructure. Significance, gap, and impediment level are described in Table 1.

Table 1 Evaluation results of influence factors; factor condition

Factor	*Sig.*	*Rank*	*Gap*	*Rank*	*I.L.*	*Rank*
Government budget	2.76	2	1.55	14	3.17	2
Private budget	1.61	23	2.29	2	2.8	7
Competency of universities	1.6	25	1.53	16	2.21	21
Competency of enterprises	2.29	5	1.73	10	2.87	5
Competency of national research institute	2.5	3	0.84	36	2.64	9
Expert training over industry and academia	1.53	29	1.89	7	2.43	12

Sig.: Significance; I.L.: Impediment level

Figure 3 Evaluation results of influence factors; factor condition



Budget scale from government and research competency from national research institute obtain the highest score in terms of significance. However, it seems that competency from national research institute is not far different from ideal level. Even the gap of budget from current government versus ideal level is not outstanding. Competency on aerospace technologies and industrialization of enterprises is considered as an influential factor for activation with remarkable significance and gap. Both budget scale from private sector and expert training system over industry and academia have large gaps though minor significance, meaning that it is hard to anticipate increased fund from private under current market size in Korea. Instead, strategic budget support from government could be more reasonable.

3.2.2 Demand Condition

Demand condition consists of both quantitative factor such as market size and its qualitative factor as essentials of market demand on commodities and service. In this study, demand condition contains overseas market and domestic stake-holders besides current domestic demands on space products and service. National defense, the main user of space technology, is considered as primary domestic demand, followed by private demand. Overseas market size as well as share over global market is considered as overseas demand. In addition to that, expectations and supports from citizens are added regarding that financial source of space development is partly depending on national tax.

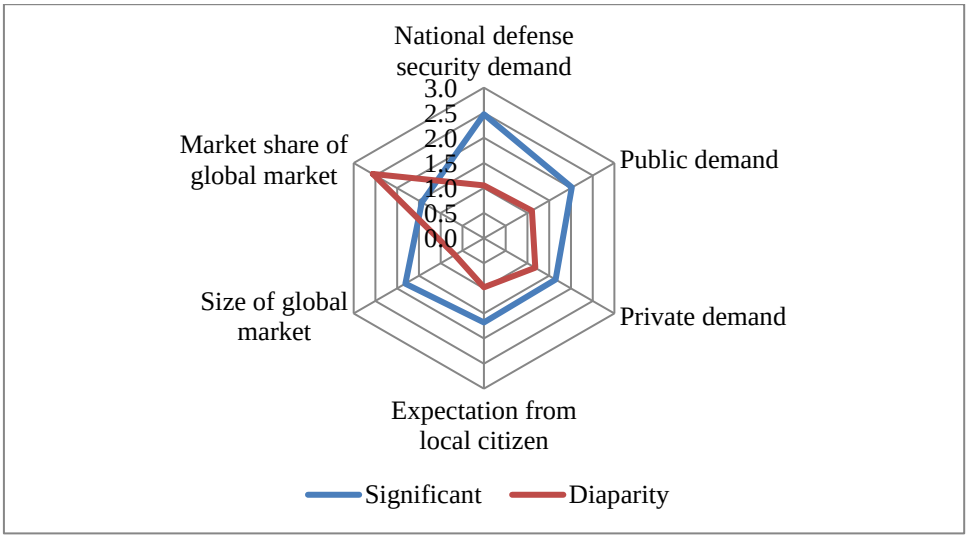
Table 2 Evaluation results of influence factors; demand condition

Factor	*Sig.*	*Rank*	*Gap*	*Rank*	*I.L.*	*Rank*
Defense security demand	2.47	4	1.05	32	2.68	8
Public demand	2.02	8	1.1	29	2.3	18
Private demand	1.65	22	1.18	26	2.03	25
Expectation from local citizen	1.68	20	0.98	34	1.95	30
Size of global market	1.81	15	0.67	38	1.93	31
Market share of global market	1.43	31	2.56	1	2.93	3

Sig.: Significance; I.L.: Impediment level

Market share of aerospace devices over global market appears to have a lower gap. This stands for current status having only a few cases of exportation of products as being intermediary role. It is, therefore, necessary to expand domestic market share in global market. Demands on technologies and products regarding public needs, such as national defense and security, have the highest significance, while the gap appears relatively low. This suggests that space development is conducted mainly by government and thus, technological demands from government and defense authority is critical. This corresponds to lowly evaluated significance and gap on private demand. On account that the main budget source and application demand come mostly from national defense authority and government, it is natural that gap between ideal and reality be low.

Figure 4 Evaluation results of influence factors; demand condition



3.2.3 Related and Supporting Industries

Related and supporting industries include either vertically or horizontally related industries and service industries supporting targeted industry. Service industry includes finance, accounting, consulting, and others. In this research, technology levels, degree of activation and utilization are studied for space related industry. First or all, technical level, size and activation degree of satellite information application are concerned. Technical level and degree of utilization are considered for defense industry, aerospace, and ICT industry that are known to make high efficiency on merging to space technology.

Relatively low significance and gap are observed from the related and supporting industries. This is mainly because current state of technical level and industrial size is not large enough to anticipate convergence toward

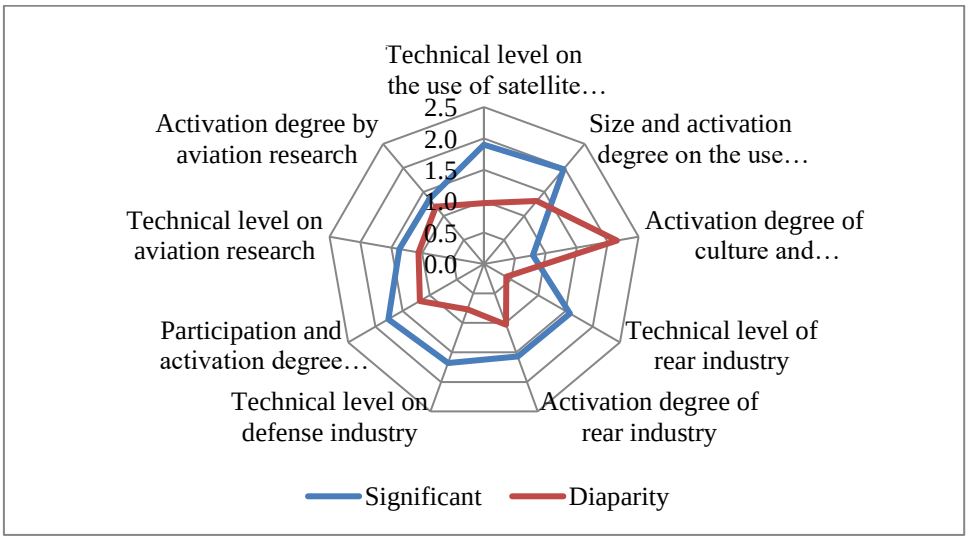
other industries. Technical level, as well as size and activation degree on the application of satellite information ranked highest significance among these factors, followed by participation and activation degree on space technology at defense industry. Although the activation degree of industry on culture and sightseeing contents has lower real-ideal gap, its impediment level seems to be low due to its little significance.

Table 3 Evaluation results of influence factors; related and supporting industries

Factor	*Sig.*	*Rank*	*Gap*	*Rank*	*I.L.*	*Rank*
Technical level on the use of satellite data	1.9	11	0.97	35	2.14	23
Size and activation degree on the use of satellite data	1.97	10	1.31	22	2.36	16
Activation degree of culture and sightseeing contents	0.79	39	2.15	3	2.29	19
Technical level of rear industry	1.58	26	0.41	39	1.63	37
Activation degree of rear industry	1.57	28	1.03	33	1.88	33
Technical level on defense industry	1.68	21	0.77	37	1.85	34
Participation and activation degree by defense industry	1.76	16	1.18	27	2.12	23
Technical level on aviation research	1.37	32	1.06	31	1.74	36
Activation degree by aviation research	1.35	33	1.19	25	1.81	35

Sig.: Significance; I.L.: Impediment level

Figure 5 Evaluation results of influence factors; related and supporting industries



3.2.4 Strategy, Structure and Rivalry

Strategy, structure and rivalry represent overall structure and strategies on creation, organization, and operation of a certain business, and the environment that create competitive relation in domestic market. In this study, propulsion system of domestic aerospace development, industrialization strategy, and competition relations in domestic and overseas market are mainly discussed, considering that most of space industry in Korea is initiated by government. As propulsion system of domestic aerospace development, R&D propulsion system concerning each role of the governmental ministry and research institution, promotive degree on the integrated enterprises and the specialized company, and establishment of the supervision organization are analyzed. In terms of industrialization strategy, exertion toward the excavation of niche market and investment on export products, exertion toward the diplomacy strategies for exportation and the discovery of overseas market, and vitalization of entrepreneurship and assistive system toward business starters are discussed. In regards of competition relations among domestic and overseas market, degree of competition among domestic markets, degree of clusterization on aerospace industry, establishment of cooperative growth over major and small/mid-size companies, and degree of motivation induced by the competition among nearby rival countries including the North Korea and the Northeast Asia are included.

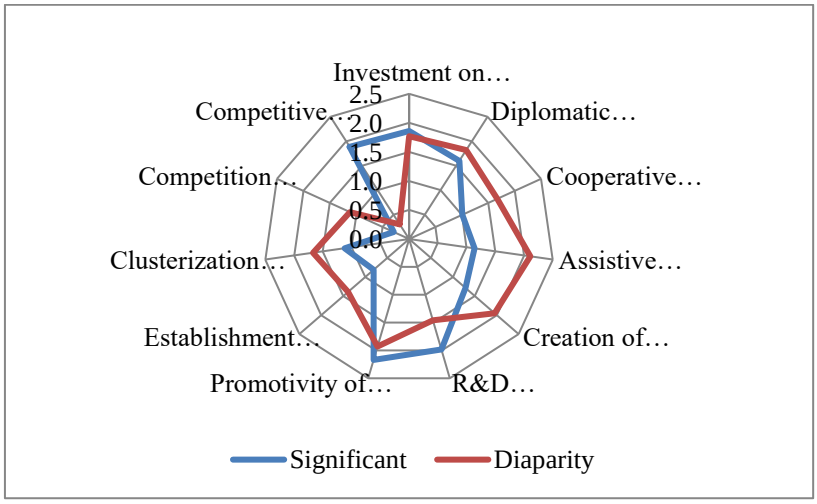
Table 4 Evaluation results of influence factors; strategy, structure, and rivalry

Factor	*Sig.*	*Rank*	*Gap*	*Rank*	*I.L.*	*Rank*
Investment on niche market and export products	1.86	13	1.77	9	2.57	10
Diplomatic strategy for global market	1.6	24	1.82	8	2.42	13
Cooperative growth among multi-level companies	1.01	37	1.67	13	1.95	29
Assistive system to business and business starters	1.14	35	2.11	4	2.4	15
Creation of new industries	1.29	34	1.95	5	2.34	17
R&D propulsion focusing each role of ministry	1.98	9	1.46	18	2.46	11
Promotivity of integrated and specialized enterprises	2.17	7	1.93	6	2.91	4
Establishment of the supervision organization	0.81	38	1.39	19	1.61	38
Clusterization on aerospace industry	1.12	36	1.67	12	2.01	26
Competition among domestic markets	0.29	40	1.12	28	1.15	39
Competitive motivation among nearby rival country	1.89	12	0.3	40	1.92	32

Sig.: Significance; I.L.: Impediment level

When it comes to significance, R&D propulsion system on aerospace study concerning each role of the governmental ministry and research institution, and promotive degree on integrated enterprises and specialized company on aerospace technology ranked the highest among these factors. This implies strategic needs to nurture specialized businesses in order to improve national research based aerospace development and establish industry bases. Exertion toward excavation of niche market and investment on export products, and diplomacy strategies for exportation and discovery of overseas market are evaluated having high significance and gap as well. Currently, most of aerospace R&D budget rely on government fund. Under such condition, government can try to reduce its budget portion by exporting space devices and related services to vitalize space industry ecosystem.

Figure 6 Evaluation results of influence factors; strategy, structure, and rivalry



3.2.5 The Role of Government

By setting the tone for environment providing innovative motivations, government policy has effects directly and indirectly on other components; factor conditions, demand conditions, related and supporting industries, and so on. This acts as catalyzer and challenger to encourage competitiveness, and therefore, is signified as the role of government. As being typically governed by national policy, aerospace industry is susceptible to government policy and its budgeting. Considering these conditions and space industry is in the early stage of its development in Korea, this part focused on the role of government; structures of decision making, budget securing system, law system maintenance, and others.

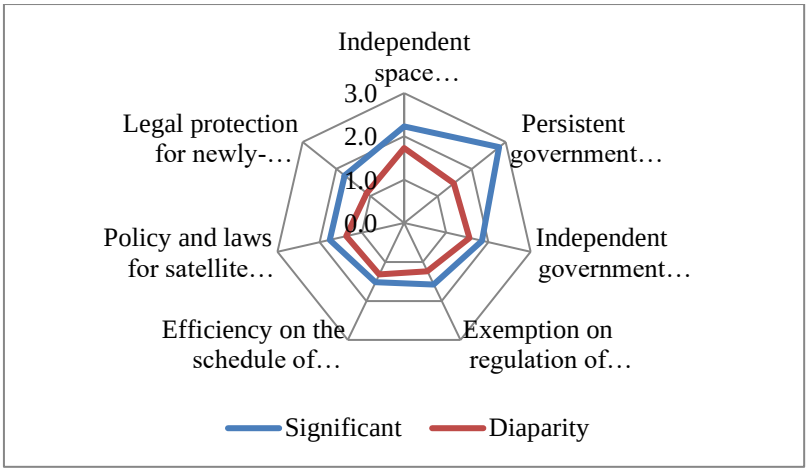
Table 5 Evaluation results of influence factors; the role of government

Factor	*Sig.*	*Rank*	*Gap*	*Rank*	*I.L.*	*Rank*
Independent aerospace governance	2.23	6	1.73	11	2.82	6
Long-term and continual governmental budget	2.81	1	1.47	17	3.17	1
Independent budget for space data by government	1.85	14	1.55	15	2.42	14
Exemption on regulation of high resolution satellite data	1.58	27	1.24	24	2.01	28
Efficiency on the schedule of purchase on space R&D	1.52	30	1.32	21	2.01	27
Policy and laws for satellite data and effectiveness	1.76	17	1.37	20	2.23	20
Legal protection for newly-developed technology	1.76	18	1.1	30	2.07	24

Sig.: Significance; I.L.: Impediment level

From the above factors, long-term and continual government budget was evaluated of highest influence factor. In Korea, space development budget is so susceptible to initiation and termination of large scale government R&D or other external changes that there are few difficulties on maintaining industrial human resources and establishing the industry foundation. Therefore, the stability and persistency are highly valued than absolute budget scale. Efforts on setting up independent aerospace governance and assigning budget properly are highly appreciated as well when it comes to significance and ideal-reality gap. This implies the importance of assembling discussion by overall governmental departments including not only the Defense Acquisition Program Administration, but also other satellite demanding departments.

Figure 7 Evaluation results of influence factors; the role of government



3.3 Analysis and Integration of Influence Factor

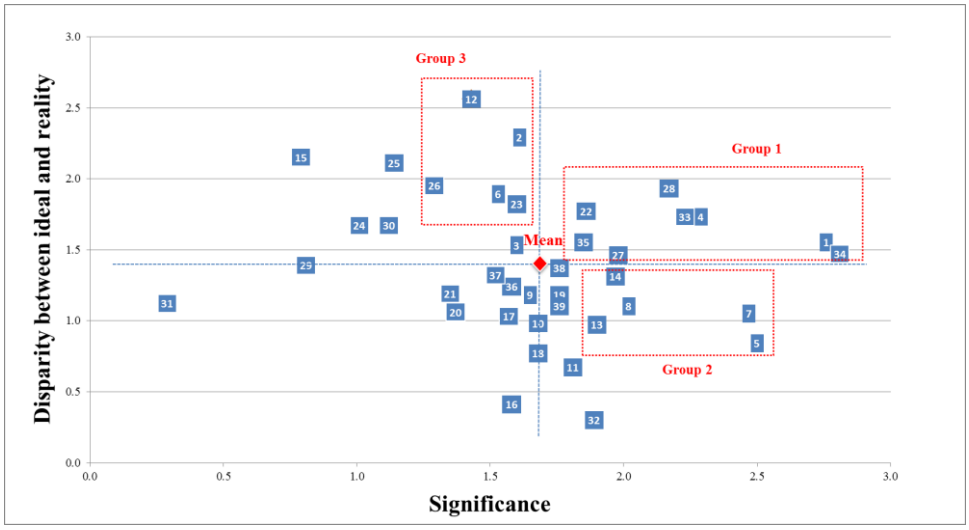
The most significant influence factors are chosen among the factors discussed in part 3 for the revitalization of space industry. The gap between ideal and reality over the significance is described in Figure 8. On the graph, group 1 appears to have the most influential factors as it has the highest values on both the significance as well as the disparity. For each factor, trends and issues are analyzed through the case analysis from both domestic and foreign.

Table 7 summarizes 8 influence factors showing the most influences with the highest values on both the significance and the gap. These influence factors are integrated and categorized into three different influence factors depending on their correlation.

1 Considering that most of the space industries rely on the governmental R&D budget in terms of both scale and type, the national finance is essential sustenance for the ecosystem of space industry. The low gap on the ideal-reality implies the necessity for efficiency on budget scale and method of investment.

2 Propulsion system for domestic space industry becomes one of critical elements establishing virtuous circle. This signifies the importance of building improvement plan for space development system led by government ministry and national research institute.

Figure 8 Disparity between ideal and reality over significance



3 Objective of the industrialization of space technology is under the creation of added value through application and development of technologies and devices. Therefore, the industrialization and overseas export will be crucial elements that can expand the ecosystem of the aerospace industry.

To sum up, three main influence factors are come up on this study. From the results discussed above, detailed strategy should be derived in order to activate space industry ecosystem.

Table 6 Main influence factors

8 influence factor	*Impediment level*	*Mean*	*3 influence factor*
Government budget scale	3.17	2.92	Budget and investment type
Long-term and continual governmental budget	3.17		
Independent budget for space data by government	2.42		
Promotivity of integrated and specialized enterprises	2.91	2.73	R&D propulsion system
Independent aerospace governance	2.82		
R&D propulsion focusing each role of ministry	2.46	2.72	Advancement to global market
Competency of technology and enterprises	2.87		
Investment on niche market and export products	2.57		

4 Elicitation of the activation strategy on space industry ecosystem

In this section, each three influence factor, issues, and domestic and foreign cases are analyzed in order to elicit improvement plan for the activation of space industry.

4.1 Budget scale and method of investment on space industry

In Korea, budget investment is usually executed short-term and has unstable supply every year. Controversies over stable financial assistance and its scale are added since the development plan of space industry has not considered integrated opinions from other governmental ministries but focused only on the opinions from MSIP and KARI. Therefore, establishing long-term and secured investment from the government based on public demand has a significant role on R&D budget investment. In order to expand budget scale on space industry, general investment including informationization budget should be considered rather than R&D budget. Depending on its application, space budget could be classified into R&D budget itself, system procurement, and construction of infrastructure so that each allocation is used for each field. In Korea, participation of space R&D among private businesses and enterprises is lagged behind. Other than just net scale of budget, specific objectives are essential to make achievements as planned. Therefore, rather than its scale, stable and persistent government fund will play a significant role. To promote space enterprises to take part in aerospace industry, it is desirable to induce the businesses gradually after establishing national space development plan with concrete projects. Prior to the establishment of national plan, national and public demands on space exploration should be scrutinized. A group of people composed with technology demanders, rather than suppliers, can be organized to predict technological demands on aerospace. Based on public demands, national space development plan can be deducted with approval from overall related ministries. Founder of the plan should consider mid-term fiscal plan of government and make consultations with budget managing department. In addition, the budget assigned to general fund rather than just R&D fund, need to be reviewed for increment. For example, satellite operational tasks revolving meteorological observation and informational purpose should be converted to general budget, where periodic management of devices is highly required. Budgets concerning storage, application, and distribution of satellite data can be reviewed for increment by converting to informationization budget management. It is reasonable to see the application of satellite data as national informationization service that concerns application by demander rather than just research development. Informationization budget in 2012 reached 3,281 billion KRW, about 12 times that of aerospace R&D. Therefore, once make connections a part of informationization budget to satellite

information application budget, secured fiscal sources of aerospace R&D can be achieved and finally, space research and development will be activated.

Table 7 Budget trend of government informationization

Contents	*2008*	*2009*	*2010*	*2011*	*2012*
Government budget on informationization	3,467	3,245	3,287	3,298	3,281
Percentage change of informationization budget	1.7	△0.6	1.3	0.3	△0.5

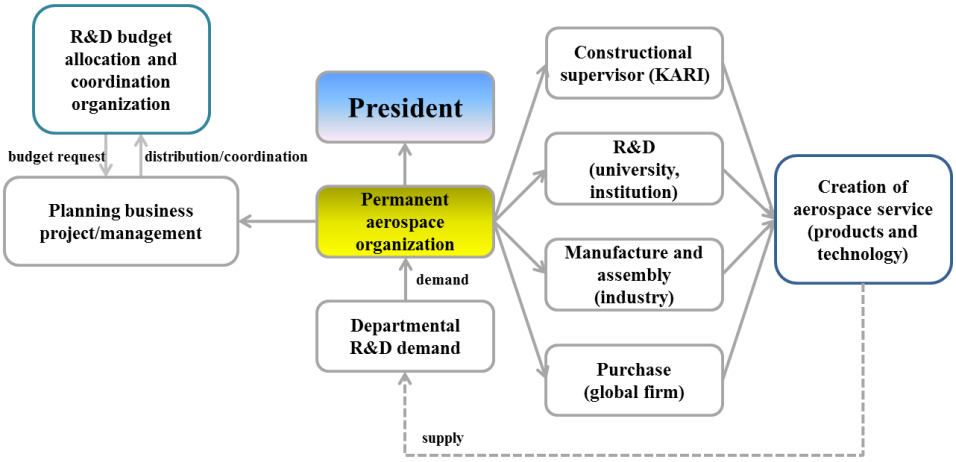
Unit: billion KRW

Entire space budget can be reviewed in various fields classified in their application characteristics; R&D, procurement of aerospace system, and establishing infrastructure. If the technology is hard to obtain via or cooperate with global market for persistently, MSIP should make intensive investment. When it comes to obtaining aerospace system for the purpose of demander application, the demander ministry should be in charge of its budget and let research institute or universities to produce the system. MSIP can be induced to relieve its budget by assigning demander ministry to fund itself to make use of climate satellite information. By converting R&D budget into general budget and introducing contract type, facilitation of development and purchase of products can be enhanced. In case of space center and large satellite experiment facilities where large amount of budget is required, exclusive management of budget should be governed by national policy.

4.2 Propulsion system of domestic space R&D industry

There have been difficulties on consistent propulsion of space R&D businesses as they are mainly executed by MSIP without regarding the entire related governmental ministries. Especially for the space R&D business, lack of permanent organization makes each governmental ministry to obtain its R&D budget by itself, and therefore makes it hard to share and interchange research results. It becomes natural to generate similar research in the end. In addition to that, roles of industry and academia are separated in the field of aerospace that the research is managed only by specific ministry and research institute. This can be worked out by establishing independent and centralized space R&D governance that can be applied to the whole governmental department. Figure 9 describes a case of independent permanent space R&D organization.

Figure 9 Propulsion system of independent permanent aerospace R&D organization



The organization should be able to assist effective consultation among main aerospace R&D governmental department including MSIP and MND (Ministry of National Defense) beside its original object of obtaining secure budget. No matter how small the organization is, it needs to be upper level organization that has roles on every single governmental department by helping building national long- to mid-term aerospace R&D project. The permanent aerospace organization takes charge of establishing space R&D project considering public demand and policy-related propulsion direction. Based on these factors, the organ will take care of procurement, distribution and coordination of the allotted budget. By focusing all space-related projects from the entire department to a single aerospace organization, the coordination between each department will be eased and redundancy among

similar projects will be reduced. Furthermore, professionalism will be fortified among governmental officials and this is expected to help long-term and secured policy execution. When it comes to keeping dispersal space R&D system, permanent organization taking care of space industry finance which takes part in establishment of space plan and development of working satellite based on public demand will be in need.

Figure 10 Propulsion system of independent permanent aerospace R&D organization

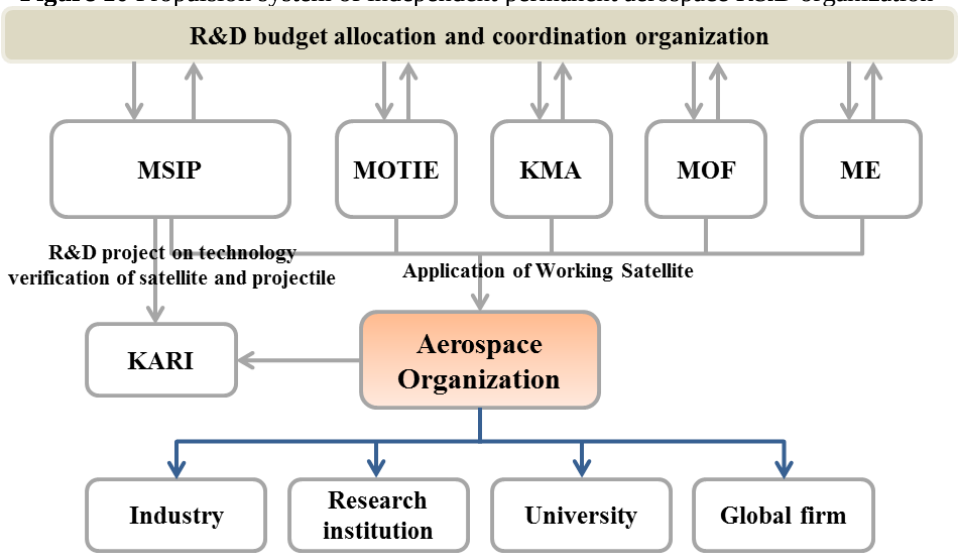


Figure 10 represents permanent aerospace organization in case of dispersal space R&D system. Major executive department and minor department are supposed to fund building permanent space organization and retain stake as both participate in managing the organization. They coordinate aerospace R&D project, collect reviews from relevant department to build up space R&D plan, manage project, and integrated management and service of satellite information. Previously, public demand on space industry has investigated formally by developers. But now, aerospace organization is in charge of surveying the demand in terms of mechanical application enhancing effective use of the technology and distributing to varied department. While suggesting effective public demand on space industry in department of satellite application, coordinated budget is expected to minimize gaps between plan and investment. Once satellite projects concerning multi-purpose and geostationary orbit satellite are placed an order in favor of aerospace organization, the organ can directly contract to KARI, other industries, and overseas firm to obtain space system. This may help building horizontal relation between KARI and industry rather than vertical that KARI used to execute space budget and industries become subcontractor. Naturally, industries can strengthen their ability by themselves. MSIP will focus more on development of critical technology elements and previous studies via KARI especially on R&D project rather than commercial projects regarding technology verification such as space launch vehicle and projectile. Satellite information that was managed and serviced by KARI, KMA, and KIOST is integrated by aerospace organization to intensify applicability of domestic space asset and minimize redundant investment. Space-related departments need to collaborate to manage the space organization and its quota investment.

4.3 Advance global market via space technology industrialization

Considering that the ultimate goal of space development is in creation of added value, industrialization and export of space technology are critical factors that expedite space ecosystem to expand. However, domestic aerospace market is restricted to small and midsize satellite, although global market is continuously expanding. Only a few domains are participating in industrialization and lack of target enterprises to export technologies is another challenge. Therefore, strategic approaches are necessary to get involved in global space market.

First and foremost, approachable target market should be chosen considering current technologies and their capacity to industrialize. Customized strategy will be designed accordingly. These strategies include setting target markets on remote-sensing satellite, landsat imagery, and additional service, and developing small economic remote-sensing satellite, landsat imagery, and other solutions. This aims at obtaining differentiated market competitiveness with improved technologies and economic price. In addition to that, it is necessary to induce targeted market to expand in the order of small-size satellite and mid- to large-size working satellite. Cooperation through G2G and technology transfer through official development assistance for underdeveloped countries will also facilitate advancement toward an emerging global market.

Secondly, conversion from government lead to privately-managed system is required for further improvement of space industrialization to encourage the roles of private sector. In Korea, aerospace industry is government-oriented and needs to blend public and private sector by increasing private roles. To keep up with the changes in satellite market and application objectives, differentiated civil military satellite besides working satellite is essential, and accordingly, diversified and specialized chain supply including cooperative program by government and private industry is required. It is also necessary to review nurturing Korean landsat image market for the expansion of global satellite image market.

5 Conclusion

So far, diversity of strategies has been proposed to enhance aerospace industry vitalization, without considering priority of influence factor. Worse, some strategies reflect interests of specific class, made it risky to realistic application. By analyzing domestic space industry ecosystem, influence factors of space industry activation, and the priority were derived to suggest better activation strategy. Total 39 influence factors were come up by reviewing existing literature and interviewing experts. Opinion of space specialists was investigated on significance and gap between ideal and reality of each factor. As a result of the investigation, the most influential three factors were selected and their improvement measurements were studied. In both investment scale and style, persistent and stable budget funding by government is highly required under precise demand prediction. General fiscal investment including informationization budget should be reviewed instead of R&D budget. In addition, entire space budget can be classified in their application characteristics; R&D, procurement of aerospace system, and establishing infrastructure. For propulsion system in Korea aerospace development, independent and centralized space development governance is needed. If maintaining dispersal space R&D system, permanent organization taking care of space industry finance concerns establishment of space plan and development of working satellite based on public demand in need. To enhance efficiency of the system, expansion of space industry's role in national R&D is highly necessitated. Finally, industrialization of space technologies and strategic plan will enable advancement toward global space market. This study is anticipated to contribute to set up effective investment indication and arrange judicial system for the activation of space industry ecosystem.

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