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Outsourcing Strategies in Europe, USA and Japan: A Case of Space Organizations*

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This paper investigates the advantages of outsourcing versus vertical integration in three geographical areas. We demonstrate in our research on space organizations the reasons why Japanese governmental activities in this industry have shifted to private companies, a shift that has also been visible in both Europe and the US in recent years. This development is not congruent with transaction cost theory nor the human resource-based view but rather with principal-agent theory. We conclude that conventional broad based economic theories have only limited application in the case of the space sector.

Keywords Outsourcing, Principal-Agent Theory, Space Organization, Vertical Integration

1 Introduction

In our research we focus on space organizations in three geographic areas: Japan, Europe and the United States. Space organizations were originally set up as governmental entities for exploration and for the commercial use of space, which can include research, development and operation of rockets and satellites, manned missions, etc. We include for Europe the ESA (European Space Agency), for the United States NASA (National Aeronautics and Space Administration) and for Japan JAXA (Japan Aerospace Exploration Agency). Special attention is given to JAXA, as this organization is currently in the privatization process. It has been noted that "The (Japanese) government is now following a policy of privatization of the space industry, for example JAXA is outsourcing some of its maintenance activities to private companies and is trying also to increase revenues through its operations" (Polak & Belmondo, 2006, p. 24).

To understand this move, we need to recall some recent events. The optimistic commercial satellite market environment of the 1990s has presently led to an overcapacity in the launch

services industry. The projected future growth convinced many launch service providers to invest in new or upgraded launch vehicles such as the Delta IV, Ariane 5 ECA and the H-IIA (Hague, 2003).

Some sort of rationalization therefore became necessary in order to stabilize this industry in the current market environment, especially since a break even point in the commercial satellite market is years away (Hague, 2003). This is one of the key aspects why JAXA is in the process of outsourcing its commercial launcher operations. In addition, JAXA is also considering expanding Japan's role in the commercial launch services world market, following an impressive record of 12 from 13 successful launches into orbit (Asahi Shinbun, 15 September 2007).

In the next section, we briefly review the research literature of classic organizational theories concerning outsourcing. These theories form the foundation for developing our three hypotheses. To verify the hypotheses we apply them to a case study described in section four. Section five follows with a discussion that includes the limitations of our study and offers a path for future research. The paper concludes with speculation on the practical value of economic theory in general vis-à-vis space organizations' outsourcing decisions.

2 Outsourcing versus Vertical Integration

2.1 General

In recent years, outsourcing has become a major issue in the economic field of research. Companies have the choice whether to outsource activities or to integrate them vertically. In the case of outsourcing activities, there is a shift of production and/or services to other companies.

The advantages of outsourcing result through several phenomena: (1) new and more flexible production technologies allow suppliers to adapt easily to their customer demands. This technical development leads to less firm-specific assets. (2) Improved communication technologies make daily operations easier. As an example of this, we can observe speedy inventory ordering by suppliers through the use of computers. (3) Increased globalization has led to pressure on many firms to reduce costs and to increase their efficiency. (4) Excess capacities enable firms to obtain discounts from suppliers. This can be caused by worldwide or geographically restricted recessions. (Brickley, Smith & Zimmerman, 2006)

Another phenomenon in regard to governmental organizations is the shortage of finance. A country in high deficit might be more willing to outsource public projects to private companies. Even in countries like Germany, we can see these developments. These savings can be seen in the bus transport industry, where in recent years more and more bus lines have either been

closed or have been switched over to private companies. All of these phenomena can be seen as reasons for forcing companies to undertake outsourcing.

Our three areas of investigation differ in respect to their market basis. There is at least in Anglo-Saxon countries an unspoken agreement that the maximization of the shareholder value is the most relevant objective (Rappaport, 1986). In contrast to this, Japan and also Europe can be considered as quite different to this Anglo-Saxon approach. Therefore, the interest of this research lies in the differences found between all three areas.

2.2 Theoretical Approaches for Outsourcing

We employ three theoretical approaches for outsourcing in space organizations, namely transaction cost theory, agency theory and the human resource-based view. We will show what specific trade-off exists between vertical integration and outsourcing and formulate our own proposition based on theory prediction for space organization's activity and finally verify this proposition for the space organization case study.

2.2.1 Transaction Cost Theory

One of the widely accepted concepts for measuring outsourcing is transaction cost theory, based on Coase (1937). According to Coase, transactions should be organized within a company as long as the costs of these transactions are lower than the transaction costs at the market. Transaction costs include searching, contracting, controlling, recontracting and the risk of delays for both sides.

On behalf of transaction cost theory, all parties use their information according to their advantages, which leads to a strategic asymmetry. To make it simple: a seller attempts to hide negative product characteristics and a buyer does not show his upper limit for purchasing a given product. This leads to each party investing in information costs as both are trying to receive more and better information. A seller might be interested in undertaking market research about their customer behavior. A buyer, on the other hand, might be interested in testing a product before buying it. In the literature, there are several attempts to overcome these contracting difficulties (Akerlof, 1970).

The transaction cost concept is the predominant theoretical explanation in management studies and basically sets out to explain governance choices and ex post contractual costs (Williamson, 1975). This theoretic concept is widely used for its analytical rigor but also criticized for overemphasizing ex post contractual influences and underemphasizing revenue creation (White, 2000).

In sum, transaction cost theory suggests that outsourcing should be considered if activities: (1) do not require investments in specific assets that invite delays; (2) are not subject to a high degree of environmental uncertainty; and (3) are those activities which the firm infrequently relies upon (Aubert, Rivard & Patry, 1996; Masten, 1984). In our case of space organizations, this industry can be characterized by a high level of uncertainty (few satellite customers dictate world market demand), with very specific assets (launchers, launch operation facilities, etc.), and who frequently rely on those assets (main part of revenue and public acceptance comes from successful launches). This leads us to our first proposition:

Proposition 1: In accordance with transaction cost theory, the outsourcing activities of space organizations would face higher transaction costs than vertical integration activities, especially when there is a high uncertainty of products, very specific assets and a high frequency on using them.

Nevertheless, in our case of space organizations, companies increasingly outsource those activities that are in contradiction to the central tenets of transaction cost theory. This leads to the assumption that transaction cost theory has a minor influence on organizational decisions compared to agency theory, the human resource-based view, and other theories. Another explanation could be that some companies or space organizations might not be able to produce certain products or to use certain technologies on their own. In this case, an outsourcing of its own activities might be unavoidable. A further reason is that reputation and repetition provide a strong incentive to the operator for providing excellent service. For example, a launch failure caused by the operator itself may have irreparable damages on its brand image (i.e. reputation) and may lead to no further orders being placed with him (i.e. repetition).

2.2.2 Principal-Agent Theory

Another dominant conceptual framework is the agency concept. The idea of the agency concept goes back to Jensen and Meckling (1976), who described the relationship between principals and agents. Principals rely on agents who carry out what the principals want them to do. The agent might be a CEO whose own interests are not automatically in line with the interests of the principal (e.g. the shareholder of the company). Worth mentioning are Holmstrom's various investigations in such models (e.g. Holmstrom, 1999). In order to attain equilibrium, agency theory emphasizes the cost of misalignment between principals and agents (Becht, Bolton & Roell,

2003). Potential misalignment conflicts arise between a principal and an agent thus causing economic costs (Jensen & Meckling, 1976).

In sum, principal-agent theory defines a trade-off between the costs for the principal of monitoring outsourced activities as parts, products and human resources in order to achieve the main goal of the principal (i.e. a cost increase) and the risks of these activities transferred to the agent (i.e. a cost reduction). Space organizations consist in our case as the principal and companies to whom activities are outsourced are the agents. Due to relatively high failure rates, the operation of launchers is very risky, thus outsourcing would be an advantage for the space organization. As there are effective quality standards and processes existing in the aerospace sector, monitoring costs caused by outsourcing would be moderate. This leads us to our second proposition:

Proposition 2: According to agency theory, outsourcing activities for space organizations would be preferable over vertical integration when the costs of misalignment conflicts caused by outsourcing are lower than the costs of risk caused by vertical integration.

This proposition is in correlation with our case of space organizations. It is relatively little effort to "monitor" a launch operator compared to other services. Risk transferring to the launch operator is high facilitation for space organizations. delays, launch failures and succession failure investigations within the organization can harm a large, clumsy bureaucratic space organization much more than a small and efficiently structured private launch operator. Another factor is that agents in a company have more incentive to work hard than in a government agency because their effort has more influence on their payoffs, e.g. salary, job guarantee, awards, etc. (Schmidt, 1996). Also the soft budget constraints theory explains this effect by the fact that governments are sometimes forced to subsidize a government entity when it performs inefficiently, whereas a bankruptcy may not be a credible threat to governmental bureaucrats it is certainly to managers.

2.2.3 The Human Resource-based View

Another theoretical explanation for outsourcing and vertical integration is the human resource-based view. According to the human resource-based view, organizations differ in their use of human resources (Wernerfelt, 1984). Organizations with superior human resources can establish competitive advantages that enable them to outperform their rivals (Peteraf, 1993).

In sum, the human resource-based view recommends to keep strategic and competitive activities in-house, because the loss of human resource knowledge cannot be compensated by the in-

crease in short-term financial advantages over the long run. This is an important aspect particularly in our case involving space organizations as these companies are more specialized. Therefore, in these organizations human resources are often critical, because they cannot easily be replicated. This leads us to our third proposition:

Proposition 3: The human resource-based view suggests that advantages accrue to space organizations that efficiently vertically integrate their activities, because outsourcing activities could lead to a loss of human resource knowledge.

Controversially, in all three investigated areas the respective space organizations outsource their strategic and competitive launch activities to a large extent, thus resulting in a major contradiction with the central tenets of the human resource-based view. This leads to the assumption that the human resource-based view has only a minor influence on organizational decisions compared to other theories in these cases. Another explanation might be that if space organizations are not able to provide their own human resources (i.e. specialists for imperative tasks are unavailable), meaning that an outsourcing of certain specific activities might be unavoidable.

3 Case Study of Space Organizations

3.1 General

In the following, we apply our theoretical models to space organizations from Europe, USA and Japan. Ranking the world's space agencies in terms of annual total cash budget size in fiscal year 2006, NASA has the largest budget with around $16 billion, followed by Europe's ESA with a budget of about $3,8 billion and the Japanese JAXA having a budget of about $2,1 billion. The Chinese Space Agency (CSA) has a budget of around $1,3 billion, the Russian Space Agency (RSA) around $1,2 billion and the Indian Space Research Organization (ISRO) has around $1,2 billion. One interesting aspect concerning the Chinese and Indian space programs is that their budgets are growing rapidly, largely as a result of the high growth rates of their domestic economies. The opposite development can be seen in Russia, where its space program has recently experienced severe budget constraints.

For the purpose of our specific investigation, we will narrow the case study to the three big players in this field, that is, Europe, the USA and Japan. Table 1 illustrates the space market structures of Europe, USA and Japan for commercial launchers. The names of organizations given in brackets are the major players, while minor players are not listed. The different life-cycle

Table 1 Comparison of Space Market Structures (simplified) for Commercial Launchers

Life-cycle	Europe	USA	Japan
Basic Research/ Concept/ Definition	Government (ESA)	Government (NASA)	Government (JAXA)
Development/ Production	Private (EADS)	Private (Boeing)	Private (IHI, MHI)
Operation	Private (Arianespace) since 1980	Private (Boeing Launch Services) since 2001	Government (JAXA) ↓ currently in process Private (H-IIA Launch Services) since 2007

phases are explained in the following.

3.1.1 Basic Research, Concept and Definition Phases

Typically, space agencies are responsible for the basic research phase. Basic research includes any fundamental research, which need not necessarily be related to a specific rocket program, such as investigations on novel propellants. Such studies are sometimes investigated over several decades. The concept phase includes preparation of a conceptual design and a system analysis. These activities are sometimes delegated to a consulting company. During the concept phase, system specifications, assessment of political restrictions and advanced development on high-risk items (e.g. rocket engines) are done. The concept and definition phase can usually be accomplished within 5 years.

3.1.2 Development and Production Phase

Typically, private companies develop and produce the rocket. The development phase means the complete development of the rocket including tests on one or more prototypes and construction of ground support if not existing yet from older rocket programs. This phase can be accomplished within 4 to 6 years. Normally, prototype flights are used to transport scientific satellites into space. If the test flights are successful, series production of that rocket starts.

3.1.3 Operation Phase

For early commercial space flights, space agencies were responsible for the operation and marketing of launchers. Later on, some space agencies outsourced those tasks to launch service com-

panies. In Europe the world's first launch service company was created in 1980, the US followed in 2001. Japan is currently in the process of privatizing the operation of launchers.

3.2 Europe

The major players for the commercial launcher sector in Europe are ESA for research, EADS for development & production and Arianespace for operation.

3.2.1 Governmental Key Leaders (Research)

The European Space Agency (ESA), established in 1975, consists of 17 member states. The ESA falls roughly within the geographical scope of the European Union (EU), however, Switzerland and Norway are also member states and there is strong cooperation with Canada. A long-term goal for the ESA is to attract all EU states to become members by 2014 (ESA, 2006). The ESA has a staff of about 1900 employees with an annual budget of about $3,8 billion in 2006. The three largest contributors are France (about 30 %), Germany (about 25 %) and Italy (about 15 %).

3.2.2 Private Key Leaders (Development & Production)

EADS was formed by its member companies in July 2000, to become the world's second largest aerospace company after Boeing. One of its divisions, Astrium with its subsidiaries EADS Astrium Transportation, is a prime contractor for the Ariane 5 launcher. This company has gone onto develop the Ariane launcher family, and is responsible for the delivery to Arianespace of a complete and completely tested launcher while managing all contracts associated with its manufactures. Member states, through the ESA, fund the development costs for the Ariane launchers and the associated technology. The company has facilities in France (Les Mureaux near Paris and Aquitaine near Bordeaux) and in Germany (Bremen). In 2006, the space division had a workforce of about 11 000 employees and consolidated revenues of $4,4 billion, representing 12 % of EADS' total revenues. (EADS, 2007)

3.2.3 Private Key Leaders (Operation)

Arianespace is a commercial launch service operator, holding more than 50 % of the world market for satellites destined for Geostationary Transfer Orbit (GTO). Created as the first commercial space transportation company in 1980, Arianespace has signed contracts for 280 satellite payloads. About 270 employees work for this company. Arianespace has 23 shareholders including

the French space agency CNES with 34 %, EADS with 30 % while all the European companies participate in the construction of the Ariane launchers (Arianespace, 2007). Although it operates as a private firm, Arianespace receives considerable, although indirect, support from the European Space Agency, which purchases Arianespace's launch services.

3.3 USA

The major players for the commercial launcher sector in the USA are NASA for research, Boeing for development & production and Boeing Launch Services for operation.

3.3.1 Governmental Key Leaders (Research)

The National Aeronautics and Space Administration (NASA) is the agency responsible for the nation's public space program. It had a budget of around $16 billion in 2006. NASA conducts its work in four principle organizations, called mission directorates: aeronautics, exploration systems, and science and space operations. The Space Operations Mission Directorate provides critical enabling technologies for much of NASA through the Space Shuttle, the International Space Station and flight support (NASA, 2006).

3.3.2 Private Key Leaders (Development & Production)

Boeing operates in four principal segments: Commercial Airplanes, Military Aircraft and Missile Systems, as well as in Space & Communications and also in the so-called Boeing Capital Corporation. Space and Communications operations, with its Network & Space Systems Division, principally focuses on research, development and the production of space systems, missile defense systems, satellites, launch vehicles and rocket engines and also the Space Shuttle and International Space Station (ISS) programs (Boeing, 2007a). In 2006, the Network & Space Systems Division's revenues were $12 billion, representing 20 % of Boeing's total revenues (Boeing, 2007b). Boeing has developed and produces the Delta launcher family. The company has customers in more than 90 countries around the world and is one of the largest US exporters in terms of sales. Recently, Boeing started to shift its core business away from commercial aircraft manufacturing toward space vehicles, communications, technical services and defense applications (MacPherson & Pritchard, 2002).

3.3.3 Private Key Leaders (Operation)

Boeing Launch Services (BLS) based in Huntington Beach, USA, is an organization that com-

bines strategic planning, business development and sales for commercial launch service customers. It is a wholly owned subsidiary of Boeing and part of Boeing's Integrated Defense Systems. BLS markets the Sea Launch and Delta IV launcher family (Boeing, 2007a).

3.4 Japan

The major players for the commercial space launch sector in Japan are JAXA for research, Ishikawajima Heavy Industries (IHI) and Mitsubishi Heavy Industries (MHI) for development & production and H-IIA Launch Services for operation launches.

3.4.1 Governmental Key Leaders (Research)

JAXA is the result of the merge between the National Space Development Agency of Japan (NASDA), the National Aerospace Laboratory of Japan (NAL) and the Institute of Space and Astronautical Science (ISAS) in 2003. JAXA went through a drastic reduction of staff and more focus has since been put on the ISS program. JAXA is now following a policy of privatization, which can be observed from various documented sources, such as "Take steps toward turning the space equipment industry and the space utilization service industry into the key industries of Japan" (JAXA, 2005, p. 24) as described in JAXA's Vision 2025.

3.4.2 Private Key Leaders (Development & Production)

The key companies involved in the development and production of commercial launchers in Japan are Mitsubishi Heavy Industries for liquid fuelled rockets (e.g. the main stage of H-IIA), IHI for the upper stages and small engines and Nissan for the solid fuelled rockets (e.g. strap-on boosters of H-IIA). Typically, these companies have in-house R•&•D that co-develop programs with JAXA, while privately financed R•&•D programs are almost non-existent in Japan (Polak & Belmondo, 2006).

3.4.3 Governmental/Private Key Leaders (Operation)

H-IIA Launch Services, as organized by Mitsubishi Heavy Industries, is Japan's newly established launch operator resulting from the privatization process of H-IIA launch operations that was initiated in 2002. The H-IIA No. 13 rocket, launched in September 2007, was the first H-IIA to be launched after JAXA's privatization program (Asahi Shinbun, 15 September 2007). H-IIA Launch Services promotes sales and marketing of launch operations to governmental and commercial customers all over the world. Furthermore, it also offers support services that are nor-

mally performed by the customers themselves, these include pre-launch operation and safety checks of spacecraft at Tanegashima Space Center, arrangement for launch-related insurance, re-launch, back-up launch and finance (Mitsubishi Heavy Industries, 2007).

4 Discussion

4.1 General

The given case study has thus been examined using the three separate theories in the previous sections, in the following section this paper will attempt to widen our point of view through a discussion centered on the coherences, alternatives and limitations concerning our applied theories.

4.2 Understanding of Coherences

As we stated in our proposition 1, the outsourcing activities by the Japanese JAXA is hard to explain using transaction cost theory. Also our human resource-based view, represented by proposition 3, carries little support. Only agency theory holds, represented by proposition 2, as it can be applied to the privatization of the operational part of the JAXA space organization.

As we stated in proposition 3, outsourcing is normally connected to a loss of knowledge, which is problematic in the area of human resources. What can be seen in space organizations is that several space organizations outsource specific production assets. However, the research part is normally covered by the space organizations themselves. Therefore, space organizations seem to benefit from outsourcing certain activities, while others are kept within the organization. Another factor is that vertical integration of activities is mainly in basic research sectors where it is not profitable to outsource activities.

The aim of JAXA is to increase the competitiveness of Japanese commercial launch services. To do this, JAXA needs to reduce costs, increase reliability and customer service. In sum, we argue that under the current organizational architecture (i. e. basic research, production and operation divisions being vertical integrated), the ability of this organization to increase its commercial competitiveness is significantly limited. The reason for this is that an efficient organizational architecture is different for a basic research division and an operation division: while for example in a basic research division the reward system needs to be optimized to elicit innovations from scientists, the reward system in an operation division needs to be optimized to motivate managers to create lean processes and high quality standards.

4.3 Alternative Theories

We selected three theories out of a pool of alternative ones, because we expect that they are best suited for our investigation centered on outsourcing strategies, while providing us with some significant results within the respective frameworks of transaction cost theory, agency theory and the human resource-based view.

We are aware that there are other theories or approaches as well, e.g. the property rights theory which posits that outsourcing stimulates efficient bargaining power (see Grossman & Hart, 1986). Also rent-seeking theory as a concept can be discussed in this area. According to rent-seeking theory, vertical integration can stop socially destructive haggling over appropriate quasi-rents (see Williamson, 1985). But vertical integration does not completely avoid contracting problems (Klein, Crawford & Alchian, 1978). For instance, influence activities (giving someone authority means that this person will be lobbied) subsequently results in high costs (Milgrom & Roberts, 1988). Finally there is also adaptation theory which stipulates that owning an asset allows the owner to determine how this asset is consequently used (see Williamson, 1975).

4.4 Limitations

Generally, the weakness of these theories is that they make speculative assumptions about human cognition and managerial discretion (Mahnke, 2001). Managers who need to decide on whether to vertically integrate or to outsource tasks, are usually faced with a general lack of relevant information. This fact is called bounded rationality, which means that human actors involved in complex problem solving are limited in knowledge, skills and time (Cyert & March, 1963). Instead managers are driven by means of an experimental search to discover possibilities for improving efficiency of the organization.

Another weakness of these theories is the limitations of scope. Essentially, transaction cost theory is restricted to the issue of the costs of writing complete contracts, while principal-agent theory narrowed focuses on the issue of moral hazard, and the human resource-based view is limited to the simple issue of linking resources to property.

The space sector has many unique features such as massive entry costs, very high quality standards, dynamically increasing returns, large unit size of production, very low production rates and imperfect competition.

Finally, it should be noted that outsourcing done by companies and done by governments has similar but not completely identical objectives. Typically, the company's motivation is mainly based on economical aspects, while the government's motivation might also be based on political

aspects. Furthermore, our definition of outsourcing is always connected to switching from governmental activities to private companies. Overall, this kind of outsourcing is much stronger than from one private to another private company.

5 Conclusion

In this paper, we explored a number of reasons why Japan's governmental space organization JAXA has recently intensified its outsourcing activities to private companies. This process has been shown to have occurred several years ago in both other investigated areas, Europe and the US.

The directional trend in outsourcing activities in space organizations therefore, is most congruent with principal-agent theory. In contrast, transaction cost theory and the human resource-based view both fail to provide sufficient reasons to explain why JAXA should more efficiently vertically integrate its activities rather than outsource them to private companies. The weighting of these three theories against each other is a difficult task and a challenge for future research.

We conclude also that economic theories can be used for a wide field of industrial sectors but have limited use in relation to the space sector. One reason for this might be that the characteristics of aerospace organizations, and in particular space organizations, are unique compared to the overall characteristics of other industry sectors.

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