Under the globalization of economies, the importance of cross-cultural management and knowledge creation increases. This study investigates the actor's role in knowledge creation in technology transfer under the cross-cultural environment from Russian basic research to Japanese manufacturing industry. Firstly, a literature survey was conducted with respect to the following: 1. means of communication and management of projects, 2. role of actors in cross-cultural knowledge transfer and the knowledge creation in projects. From the survey, the model of "duel core" actors is proposed and verified. The duel core actors are people who communicate on both the sender side and the receiver side. The necessity of core actors is discussed in many examples of previous research, sometimes identified as a "gatekeeper" or a "transformer". However, there is no research which points out that such core actors need to exist on both sides, communicators functioning as dual core actors. For product development, smooth, and appropriate communication and knowledge transfer becomes important, and the actor's role in combining internal and external ideas is indispensable.

Hidemi Yashiro

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Preface

Under the globalization of economies, the importance of cross-cultural management and knowledge creation increases. The capability of offshore development becomes the key success factor, and companies are required to face diversity and open innovation.

This study investigates the actor's role in knowledge creation in technology transfer under the cross-cultural environment from Russian basic research to Japanese manufacturing industry. Firstly, a literature survey was conducted with respect to the following: 1. means of communication and management of projects, 2. role of actors in cross-cultural knowledge transfer and the knowledge creation in projects.

Secondly, 52 projects in multinational environment are investigated. From the survey, the model of "duel core" actors is proposed and verified. The duel core actors are people who communicate on both the sender side and the receiver side. From this study, the model of "duel core" actors is verified. The dual core actor is one of a pair of actors, who exist on both sides, functioning as both a sender and a receiver. The necessity of core actors is discussed in many examples of previous research,

sometimes identified as a "gatekeeper" or a "transformer". However, there is no research which points out that such core actors need to exist on both sides, communicators functioning as dual core actors. Therefore, the theoretical contribution this study identified is that dual core actors are necessary in remote cross-cultural communication.

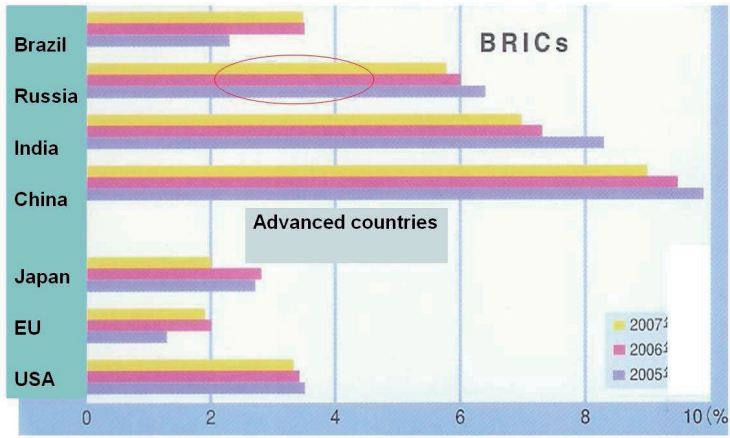
For product development, smooth, and appropriate communication and knowledge transfer becomes important, and the actor's role in combining internal and external ideas is indispensable. In this sense, the dual core actor is the innovator and the driving force for cross-cultural communication and management. The business and operational implication of this study is that it is necessary to locate and appoint duel core actors on both the sender side and the receiver side in order to create new knowledge by fusion of different cultures.

1. Introduction

Under globalization, the necessity of open innovation is increasing for new product development. This is because new economies such as the BRICs (Brazil, Russia, India, and China) show a remarkable growth. According to IMF (2007, Figure 1) the BRICs countries mark the growth which exceeds other advanced industrial countries as the economic power. New economies are becoming more important as trade partners and resource providers since they have ample population and natural resources.

With the globalization of economies, the importance of cross-cultural communication and management increases. Companies are facing the challenge of surviving while coping with the fast growth of new economy. To be able to utilize a wealth of resources in the BRICs, effective cross-cultural communication and management are required. For product development, smooth and appropriate communication and knowledge transfer becomes important. The capability of offshore development becomes the key success factor. As Drucker (1993) predicted, a new economic situation will increase the intellectual importance and ability of utilizing the knowledge assets regardless of culture, nationality, or region.

Figure 1 Economical Growth Comparison

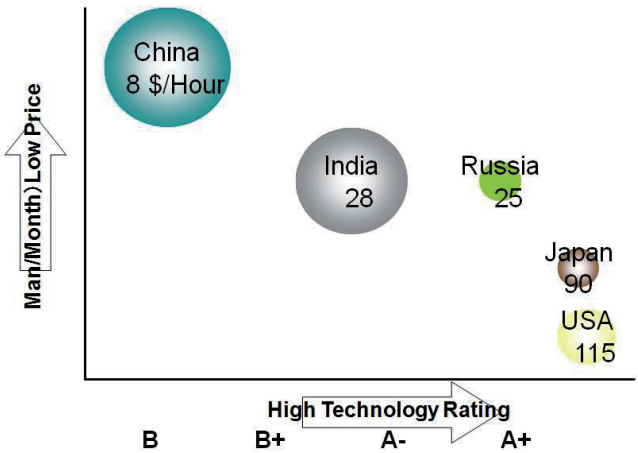


Source: IMF 2006

In Japan, fundamental research expenses are being reduced, according to the Statistics Bureau of General Affairs Ministry (2004), and Yamaguchi (2000). They indicate that Research and Development in central laboratories was reduced in many companies in Japan during the 1990's. In order to make up for the fundamental research, the necessity of the open innovation is proposed (Chesbrough, 2003). It means that links to outside organizations are required. This is the reason that the

capability of offshore development such as with Russia becomes one of the factors for success. Companies are required to face diversity and open innovation. Therefore, it is important to develop effective methods for collaboration and for working with the BRICs.

Figure 2 Competitive Power of BRICs



Source: UBS Warburg, et. al http://www.stat.go.jp/data/sekai/02.htm(2002)

Among the BRIC countries, Russia is unique. Russian labor costs is not as low in comparison with the others, so out-sourcing low-level jobs to Russia is not as

beneficial for reducing costs (Figure 2). But for technology level in terms of wages, Russia is superior to China and India. Russia adds elements such as scientific creativity and innovation in addition to cost and quality.

The benefits of collaboration with the BRICs are typically cost, quality, and availability of labor. Fig.3* shows their competitive power. It shows the size of population as the pie size, level of wages as dollars per hour dollar on the Y-axis, and the rating of technology level on the X-axis.

Here, the availability of manpower and cost of labor is one of the key merits. China and India are outstanding in this regard. Industrial countries can benefit from outsourcing to the BRICs, especially China and India, in terms of ample labor and low cost. Industrial countries can reduce their cost of doing business by conducting some part of their business outside the industrial countries. In terms of availability of labor, China is outstanding among the BRICs. Labor costs in China are also low, and India follows China. Therefore, the BRICs occupy an important place in terms of out-sourcing.

2. Research Review

In this section, previous research is reviewed considering inter-firm cooperation in R&D in a multinational environment. Firstly, research on cross-cultural management is investigated, then research on knowledge transfer and knowledge creation in cross-cultural management is reviewed.

2.1 Cross-Cultural Management

(1)Factors of Cross-Cultural Management

In cross-cultural management there are multiple factors to be considered. Harris and Moran (1979) divide the consisting elements of cross-cultural management into ten factors; 1. Language, 2. Clothing, 3. Food, 4. Time dimensions, 5. Honoring system, 6. Human relations, 7. Value and model, 8. Distance between self and other people, 9. Learning process, and 10. Religion and faith.

Hofstede and Bond (1984) classify the administrative culture in four axes; power distance, uncertainty acceptance vs. avoidance, individualism vs. collectivism

and masculinity vs. femininity. The research is driven by results of an investigation of offices of IBM in 70 countries. Holden and Tansley (2007, Table 1) point out that management is influenced greatly according to variables of the country level.

Table 1 Obstruction Factor To Knowledge Sharing In Russia

Type of Influence	Typical situation	Hostility of knowledge sharing in organizational level
Individual who has knowledge	Want to protect your own value knowledge sharing is troublesome	To protect the existing value To keep face in front of subordinate To protest against knowledge sharing
Negative aspect of knowledge sharing i	Refuse to disclose own failure Afraid to fail	Russian culture do not allow to discuss failure with others Not accustomed to look back the failure
NIH syndrome	Negative concern for outsiide kn owledge Prioritize the own idea	Royalty to the regulation and rule Strong collectivism Hostilities to outsiders

Source: Edited from Holden and Tansley (2007) p. 322

(2)Types of Cultures and Communication

There are many studies which discuss different aspects in

types of cultures and communications. Hall (1976) divides cultures into the high context and low context. A high context culture is a culture that emphasizes tacit consent and atmosphere. A low context culture is a culture that communicates by the actual language expression of text messages. High context cultures include Japan, Arabic countries and a part of the Russian Federation. Germany or Switzerland is regarded to be a typical low context culture.

Trompenaars and Woolliam (2005) analyze cultures based on “the merit system” vs. “the attribute system”. The merit system is based on personal achievement, while the attribute system is based on the principle of age, sex, social rank, and educational background. According to Trompenaars and Woolliam, a typical culture based on the merit system is America. The attribute based cultures include the Confucian countries such as Japan or the Republic of Korea. Countries of the Middle East are considered to be attribute based cultures.

Samovar et al. (1981) point out that cross-cultural communication occurs when the sender and receiver belong to different cultures. Here culture affects both the content of the message for both the sender and receiver.

(3) Characteristics of National Cultures

Michailova (2004) compares Chinese culture with Russian culture and points out commonalities. They have the tendency to emphasize personal connections. Michailova also stresses that in Russia and China the power that is achieved by personal connections in knowledge transfer is strong.

Hakamada (2002) describes the characteristics of Russia compared with Germany, Japan, Britain, America, France, Italy, and China. According to him, it is assumed that an authoritarian system such as modern Russia as well as modern China is due to the political system.

Michailova (2004) and Hofstede and Bond (1984) point out that Russians receive strict education about handling secrecy. Elenkov (1998, Table 2) studies effective management methods of Russians working in American companies. according to her comparison, mentality of Russian people are more power orientation and have strong collectivism compared to those of Americans. although the political risk is high, risk allowance is low and have low competitiveness orientation. Accordingly the flexibility to new idea is low but these tendencies might change as the market economy expands and spreads

through the nation.

Table 2 Cross-cultural Comparison of Mentality of Russian Elenkov (1998)

Description	Russian	American
Power orientation	High	Low
Ideology	Collectivism	Individualism
Competitiveness orientation	Low	High
Allowance for risk	Low	High
Political influence	High	Low
Flexibility to new idea	Low	High

Source : edited from Elenkov (1998) p.139,

He points out that compared with an American, Russians have high power orientation, and furthermore, Russians are risk averse and intolerant of political fallout.

Engelhard and Nagele (2003) conducted research on 22 MNC (multi-national companies) in Moscow. According to the investigation, neither of management system based on an European value system nor American culture is hard to be understood or implemented in Russia.

2.2 Knowledge Transfer in Cross-Cultural Communication and Management

(1) Technology Transfer and Cross-Cultural Communication

Technology transfer is indispensable for the inter-firm cooperation in R&D and product development such as open innovation. According to Tech-Encyclopedia (2009), technology transfer is one form of cross-cultural communication and the definition of technology transfer is; 1. Applying the results of research to a practical application, and 2. Sharing technical information by means of education and training.

With globalization of technology, international technology transfer is promoted. From the viewpoint of the international technology transfer, Saito (1979) investigates the technology trade between advanced industrial countries and developing countries. He insists that utilization of technology contributes to the global economy, political stability, and nurturing culture. He mentions that it can be the base of sustainable international development or, more over, world peace.

Schumacher (1973) points out the fact that the efficiency

of technology transfer is controlled by the peripheral environment. He places “an intermediate technology" located in the middle of the transitional technology to make technology transfer more effective. Thus, Kobayashi (2005) indicates that the technology from western countries was modified and transferred successfully in Japan, and modified western technology still holds an important position.

Zander and Kogut (1995) analyze a case of organizational technology transfer, and prove that morality, the value system, and local culture, including human relations, play important roles. In the technology transfer, various conditions such as technology standards, resources, scale of the market, and the social culture environment of a country transferred to have to be considered.

(2)Difference of Technology Transfer and Knowledge Transfer

As for the definition of the technology transfer, Goc (2002) mentions that the technology transfer means an exchange and transfer of technical resources. In a narrow sense, it is accompanied by techniques such as patents, licenses, royalties, and joint management enterprises.

Gopalakrishnan and Santoro (2004, Table 3) compare knowledge transfer with technology transfer and conclude that technology transfer is narrowly defined, and knowledge transfer broadly defined.

Table 3 Key Dimensions of Technology and Knowledge Transfer

Dimensions	Technology	Knowledge
Breadth of construct	Narrower and more specific construct. Technology can be seen as an instrumentality or set of tools for changing the environment	Broader and more inclusive construct. Knowledge embodies underlying theories and principles related to cause and effect relationships
Observability	More tangible and precise	Less tangible and more amorphous
Overarching Characteristic	More explicit and codified where learning can be taught and information is stored more in blueprints, data bases, and manuals	More tacit where learning is by doing and information is stored more in people's heads
Management Phase(s) of most consequence	Post-competitive phase of technological development (Integral for the commercialization of ideas and inventions)	Pre- and Post competitive phases of technological development
Organizational Learning	More reliance on controlled experiments, simulations, and pilot-tests	More trial and error, wider use of gestalts
Nature of Interactions	Inter- and intra-organizational interactions that deal most with operational issues and how things work	Inter- and intra-organizational interactions that deal most with strategic issues and why things work the way they do

Source: Gopalakrishnan and Santoro (2004)

Technology transfer uses tools such as manuals, experiments, simulations, and pilot tests. Knowledge transfer uses tacit or implicit methods. Here, logistical elements in the background such as corporate culture, the technology background or organizational relationships are important.

According to Goc (2002), knowledge transfer is done before and after technology transfer. Furthermore, knowledge transfer occurs after the technology transfer is completed, and when the project shifts to the next stage.

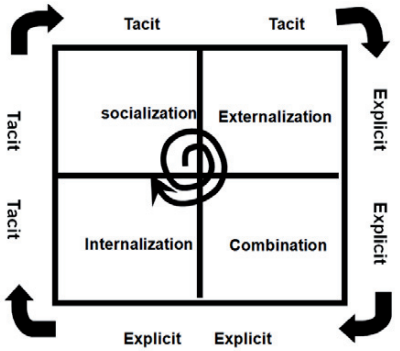
In summary, knowledge transfer is considered to be technology transfer on a wider scale. Knowledge transfer is more difficult than technology transfer. Knowledge is transferred usually by means such as trial and error, and through OJT (On-the-Job Training). Technology is not transferred just as a single element but is transferred as knowledge as a whole.

2.3 Knowledge Creation in Cross-Cultural Communication and Management

(1)Cross-Cultural Management and Knowledge Creation

Holden (2002) introduces a new viewpoint regarding new knowledge creation in cross-cultural management. Holden obtains his idea from the SECI model, (Nonaka & Takeuchi, 1995, Figure 3), the way Japanese companies create the innovation dynamics through collaboration among different types of organizational cultures. Prior to Holden's research, the traditional approach was to focus on cross-cultural differences and similarities. However, Holden insists that there is the potential of bring-in innovations in cross-culturally diverse projects.

Figure 3 SECI Model



Source: Nonaka & Takeuchi, 1995

Porter (1985) develops Holden's idea into the idea of cross-cultural diversities as intangible assets. He introduces a competitive strategy theory. Barney (1991) placed knowledge as one of the competitive assets of corporations and made a base of his "resource based view". For a company to maintain competitiveness, it needs to have resources which others cannot imitate (Hamel and Prahalad, 1990). Holden advances Nonaka's (1995) theory, focusing on the heterogeneity of a combination of cross-cultural management theories.

(2)Actors in Cross-Cultural Knowledge Creation

As a transmitter or medium of communication of a knowledge, the existence of "a gatekeeper" or "a boundary spanner" (a border connecting person) is studied. Allen (1979) examines a communication network used by an engineer. He found the existence of a central person in knowledge transfer, labeling the person "a gatekeeper." The “gatekeeper" takes the role of promoting knowledge transition and he or she eliminates semantic noise. Such noise occurs due to lack of common understanding between the people concerned in communication.

In addition, there is “a boundary spanner” who is another medium of communication. The boundary spanner collects necessary information for an organization from the outside. Then, he or she analyzes it, and disseminates it within an organization （Tushman, 1977, Adams et al., 1980）

3. Survey

Based on the previous research, fifty-two cases of cross-cultural projects between Russia and Japan are analyzed. Break down of 52 projects are shown in Table 4. Russia is one of the BRICs countries, showing a steady economic growth. Among the BRICs, Russia exceeds India, China, and Brazil on GDP per person. It has strong technological potential for offshore development, resource diversity and further innovation.

Table 4 Break Down of 52 Cases

No	Year	Japanese Partner	Industry	Content of Project
1	1988	CommercialResearch	Research	Purchase of Russian market research
2	1988	NEC Service	PC	Semiconductor development
3	1989	Iwatsu	Communication	Licensing of decoder made in Russia
4	1990	NEC(Laivex)	PC	Sale of Russian CD-ROM
5	1991	IDO	PC	PC application search
6	1992	Softbank	PC	Research on Russian game
7	1993	Diamond Publishing	Research	Research on IT business potential
8	1993	Chemical Eng. Association	Research	Research on technology allaiance with Russia
9	1994	NEC	PC	Sale of Russian PC application
10	1994	Atlus	Game	Held game contest

11	1994	Sega	Game	Porting of Japanese Game
12	1996	AizuUniversity	Software	Research and hiring of Russian engineer
13	1995	Namco	Game	Sale of Russian Game
14	1995	TransCosmos	Software	Sale of Russian security software
15	1996	Toshiba R&D	Electronics	Research on computer interface
16	1997	JRC	GPS	Introduce Russian GLONASS
17	1998	OpenText	Software	Image compression software development
18	1998	Ricoh	Electronics	Image processing software development
19	1998	JapanPersonal ComputerAssociation	Research	Market research
20	1998	Marubeni Utility	Research	Russian industry survey
21	1998	Sony	Research	Start R&D in Russia
22	1999	Panasonic	Electronics	Sale of Russian barcode reader
23	1999	Furuno	GPS	Introduce Russian GLONASS
24	1999	Tokyo University of Mercantile	GPS	Introduce Russian GLONASS
25	1999	Intelligent Wave	Software	Sale of Russian security software
26	1999	DX Antenna	GPS	Introduce Russian GLONASS
27	2000	Toshiba/Solid Ray	Electronics	Image processing software development
28	2001	Diichi Kosho	Game	Research on interface
29	2002	Photonix	Electronics	Sale of Russian game in Japan
30	2002	Data East	Game	Sale of Russian game in Japan
31	2002	Hiroshima Univ	Software	Voice processing software
32	2002	Sanshin Electric	Communication	Image compression software development
33	2002	Kyocera communication	Communication	Voice processing software
34	2003	Nagoya University	Aerospace	Voice processing software
35	2003	Ricoh	Electronics	Sale of Russian barcode reader
36	2004	Shinko Trading	Semiconductor	Image compression software development
37	2005	KDDI	Communication	Voice processing software
38	2006	Iphone	Semiconductor	Voice processing

				software
39	2007	D&M	Semiconductor	Voice processing software
40	1998	Marubeni	Energy	ISTC Technology Transfer
41	1998	Tohoku University	Material	ISTC Technology Transfer
42	1998	Field Geo Cycle Farm	Biotechnology	Bio recycling
43	2001	Horiba	Nanotechnology	Development of measuring instrument
44	2002	Komatsu	Nanotechnology	Sale of device for semiconductor development
45	2003	SDKK	Nanotechnology	Semiconductor development
46	2004	Ajinomoto	Biotechnology	Synthesis of Amino acid
47	2005	JASDA	Aerospace	Launch of rocket in Russia
48	2005	Shimazu	Nanotechnology	Sale of measurement instrument
49	2005	NEC	Electronics	Circuit design joint venture
50	2006	TII	Software	Development of measuring instrument
51	2006	Justsystem	Software	Licensed Kaspersky Anti-Virus
52	2006	Information Security	Software	Joint venture with AvitelData

3.1 Overview of Survey

(1)Russian Technology Application in Japan

As for Russian economy, it was once depressed after the collapse of the Soviet Union in 1991, but nowadays it shows remarkable growth. Compared to other countries in the BRICs, the standard of living and education in Russia are very high. Russia keeps the highest number of research

and development personnel in the world in terms of population. Russia exceeds India and China in higher education (International Bank for Reconstruction and Development (2006). Russia has strong potential for fundamental research (BowWave Technologies, 2002, Figures 4 and 5).

Figure 4

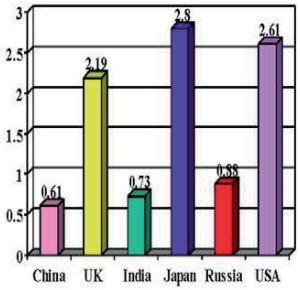
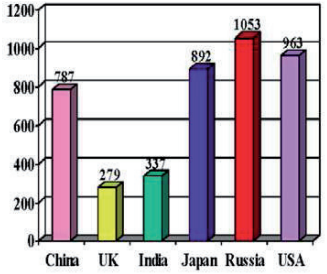


Figure 5



Source: BowWave Technologies, 2002

As for Russian R&D potential, Russian has strong human resources, especially in science and technology. Russian technologists can create and provide many new product ideas. The former Soviet Union had a population of 288,000,000 in 1990, 5.44% of the world population.

Within this share, the ratio of a science/technology engagement people is 6 times that of its population ratio. This is because scientist received the highest respect in the Soviet Union, and scientists were given abundant funds and time. Russia is outstanding in the number of science/technology workers, and no country in the world can come close to the Russian number.

The education system in Russia also excels that in many countries. For example, the Russian and Japanese populations are about the same size, but the total number of Russian schools is almost 160,000 while Japanese schools are only 60,000. In other words, Russia has 2.5 times more schools than Japan. In Russia, the number of people engaged in education is about 6 million, while in Japan it is 1.7million. Morimoto* indicates that Russia as a nation has significant potential to provide quality human resources for scientific advancement. As for number of Russian science/technical researchers, it recovered slightly with 887,700 people in year 2000. Bzhilianskaya indicates Russian technology and its highly educated personnel usage and activities on the modern American market (Bzhilianskaya, 2001).

The number of engineers in Russia is not so different from that in Japan, but there are twice as many science

students in Russia as there are in Japan, the U.S., and India. Among students, the number of graduate degree holders is also increasing steadily and it has attracted attention overseas.

In Japan, human resources in science/technology are decreasing year by year as the Japanese population decreases with the falling birth rate. The Japanese birth rate has been at the record low for many consecutive years. Number of scientist and engineer decrease faster than the population decrease. Also, fewer students in Japan now choose to major in science/technology.

(2)Classification of Survey

The classification of 52 product development projects is shown in the Table 5.

Projects are classified by fields, industries, types of business, and the monetary size. The number of projects in the public welfare sector are 35, the basic level product development are 29, the application level product development are 23, and the defense area are 17. In terms of the amount, 50% came from IT and electronics projects, and 21% from biotechnology, 10% from aviation / space, and 19% from nanotechnology.

Table 5　Break Down and Classification of 52 Projects

Field	No.	Type	No.	Industry	No.	Amount%
Military affairs / national defense	17	Basic level	29	IT・Electronics	40	50
Public	35	Application level	23	Biotechnology	2	21
Total	52	Total	52	Aviation / space	5	10
				Nano technology	5	19
				Total	52	100

(3)Definition of the Degree of Success

The degree of success for each project is measured by the impact of contributions, which are roughly divided into three categories:

①the monetary size of a project

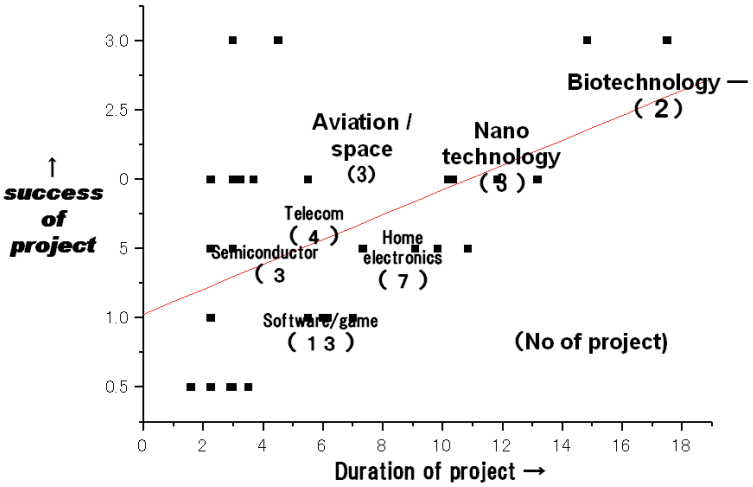
②the number of repetitions of a project

③satisfaction level of participants after the project

As for ①the monetary size of a project, the project size is divided by large (over one million US dollars, medium

(more than 30K and less than one million US dollars), and small (less than 30K US dollars). As for ②the number of repetitions of a project, the actual number is counted. As for ③satisfaction level of participants after the project, project participants were asked to respond to a questionnaire after the project completion. They were asked to rate items very satisfactory, not satisfactory, or neither of the above. For each of the three kinds of contributions, ①, ② and ③ the full score is 100% and the three are totaled to be weighted equally. Thus the maximum value of the degree of success is 3.0.

Figure 6 Correlation of Success Degree (Y) and Duration of Project (X)



regression equation is Y=1.03112+0.08939X and correlation coefficient is R=0.4813. Among 52 projects, biotechnology projects show the highest degree of success, and the next is aviation / space. Nanotechnology projects are the third. The results show, the degree of success and duration (X) of each project has a strong correlation. Projects such as biotechnology, nanotechnology, and aviation space show above average rates of success. Some IT and electronics projects show above average rates of success, but some are significantly below average.

3.2 Analyses of Actors

Among 52 cases, all cases had either one or two actors in existence. In 95% of the cases, that actor is an engineer. Many actors are executives and also experts in advanced areas, especially in fields such as nanotechnology, biotechnology and aviation space.

The results below are considered with respect to personnel type. The categories used for classification are the number and type of actors, cross-cultural communication level and overseas experience of actors, presence of offline communication, frequency of offline communication, period of communication, and level and strength of motivation by actors.

(1)Numbers and Types of Actors

As for the types of actors, 95% of actors have a high level of technical background. Also it is a necessary condition that such actors have an influential position in the organization.

Figure 7 shows a correlation of communication proficiency and overseas experiences of an actor (X) and the success of a project (Y).

Regarding the success rate, there is a weak positive

correlation (r=0.33, y=1.41+0.05x) between the communication skill of the actor and success of the project. The communication skill of the actor is measured by the English proficiency and overseas business experience of the actor, and is measured by the 0~20 scale.

Figure 7 Correlation of Success Degree (Y) and Communication Skill of Actor (X)

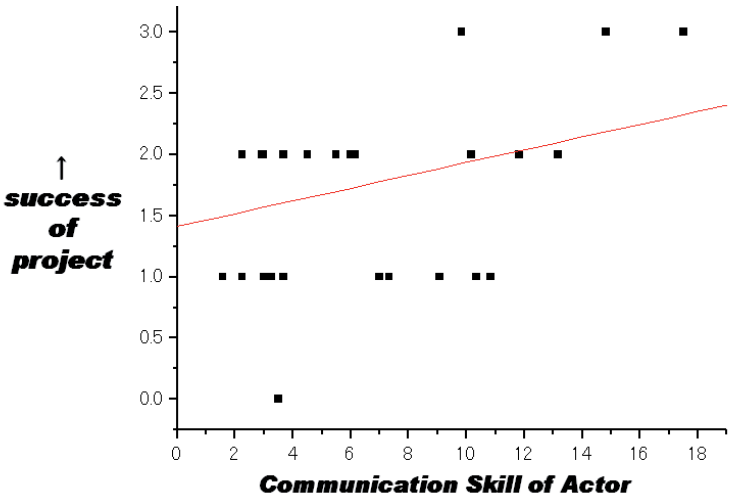
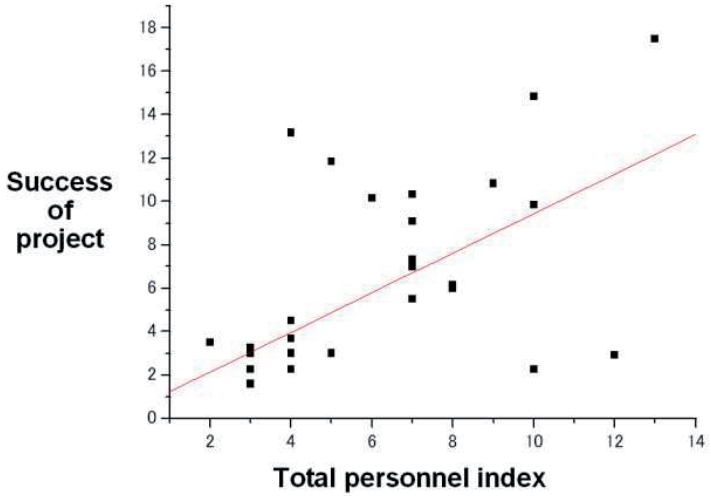


Figure 8 Correlation of Success Degree (Y) and Total Personnel Index (X)



The total personnel index includes elements such as the presence of offline communication, the frequency of the offline communication, and a duration of communication (Figure 8). The personnel index has a stronger correlation ($r=0.61$, $y=0.31+0.91x$: Figure 7) with success than the correlation of the communication skill of the actor. This means that the presence of offline communication and the frequency of the offline communication contribute to the project success. The offline communication means the

communication that does not rely on an electronic medium, such as an email and fax. It includes unofficial eating and drinking. Other than the official face-to-face communication in meetings, the unofficial communication is effective when people are reluctant to express opinions openly. Actors can facilitate communication in unofficial communication situations by understanding each other's intention, which is not expressed usually in official meetings.

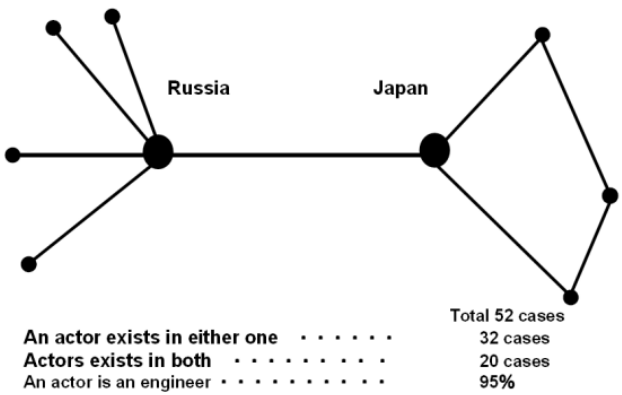
(2)Network of Actors

Among the 52 cases, the average number of actors was 1.36 / case. It is the necessary condition for success that at least an actor) exists. In case of group communication, Leavitt (1951) indicates four types; "the circle type", "the chain type", "the Y character type", and "the wheel hub type". Each type has various functions in communication, i.e., regarding efficiency, and the morale of project members. Based on this survey, Furuta, et. al (1996) point out that the typical communication style of the Japanese is the circle type, and the typical European and American communication is the wheel hub type.

When successful cases are analyzed among the 52 surveys,

it is found that the Japanese side actor is the circle type, and the Russian side is the wheel hub type (Figure 9). All successful cases have actors existing in a pair, on both the sender/ receiver sides. Having actors on both the Russian side and the Japanese side raises the success rate. Twenty cases among the 52 cases have actors on both the Russian side and the Japanese side. Actors act as “dual core” communicators in both sides of the project.

Figure 9 Networks of Actors



Powell and Grodal (2005) mention that the establishment of relationship between the sender and receiver is

important even before the knowledge transfer. With a tighter relationship between the sender and the receiver, a more complicated level of knowledge transfer becomes possible. For the cross-cultural knowledge transfer, it is necessary that the dual core actors function as key men.

(3)Knowledge Transfer to Create New Products

A role of an actor is to mediate between the basic research and the product development. Russia is superior in basic sciences such as nuclear physics, which can be connected to the new product development by means of Japanese company's knowledge. The effective knowledge transfer from Russian science to Japanese companies can create new products which have never existed.

In 52 cases, many show valuable outcomes in new product development. Some introduce innovational products in the nanotechnology, biotechnology, and aero space fields. Such results come from effective collaboration on basic science and product development.

(4)Knowledge Creation Model of "Dual Core" Actors

Actors work as the medium. They strengthen

communication and cooperation within both parties. When an actor understands and communicates new knowledge, he or she can learn faster from a partner. He or she can also acquire the tacit knowledge such as the experience or the sense of judgment. It leads to a new knowledge creation. In this way, an actor becomes effective mediator and the acquisition of the knowledge will be activated effectively.

In the following cases, actors knew both the fundamental research and development. As discussed in the research review above, such an actor is "bilingual", and a talented person. He or she collects necessary information for the organization from outside the organization and analyzes it. In addition, he or she spreads it within the organization, playing the role of “boundary spanner (border connection personnel)”. In successful cases of the knowledge transfer, such an actor exists in both sides as a "dual core" actor.

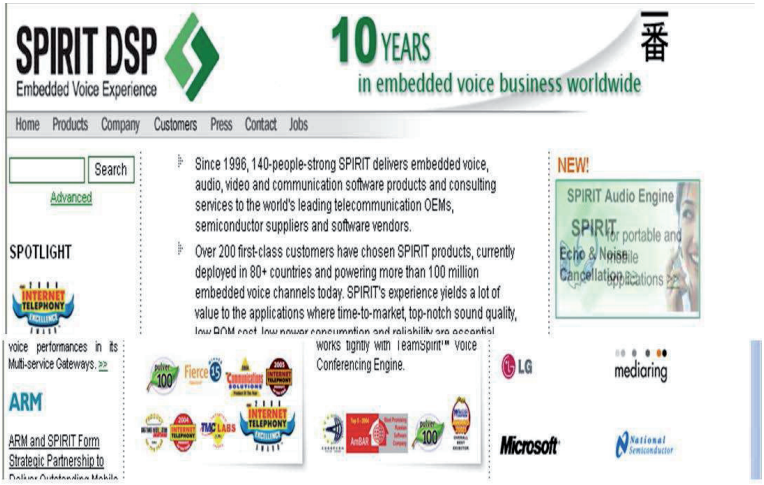
3.3 Case of Russian technology application in Japan

(1)Case of IT

One case of Russian technology application in Japan is SPIRIT Corp. their website with Japanese Logo is shown on Figure 10. SPIRIT provides unique model of providing

various technology to create consumer products together with Japanese companies. The author serves as the Japan representative of SPIRIT Corp., a promoter of technological transfers in Russia (Yashiro 2004). So far SPIRIT extended many products ideas based on technology to more than 40 Japanese companies.

Figure 10 SPIRIT Corp. Website with Japanese Logo



Source: SPIRT Corp. website accessed on Nov. 2006

SPIRIT is a Russian software company founded in 1992 by Andrew Sviridenko, who acted as the Russian side actor. He focused on the application of existing Russian

technology to civilian use in Japanese market. The company covers algorithmic areas such as security and is applied to aerodynamics, image processing, and satellite navigation and others (Table 6). Those technologies can be used for CAD, semi-conductor design, and most easily, game and entertainment design. The company is widely publicized by the media in Russia. It focuses on the unique talent and engineering skill which exist in Russia and has provided worldwide service to many multinational corporations. Japan is the first country to become interested in SPIRIT's potential and capability. Many Japanese companies came discuss joint product development with this Russian software company.

Table 6 Technology Transfer Project SPIRIT Company(Partial)

No.	Field	period	Content of project	Japanese partner
1	Image processing	1994 ～ 1996	Overseas porting of game libraries	DataEast, Namco, Sega, Atlus
2	Semiconductor	1995	Development of DSP	NEC
3	Aerospace	1995 ～ 1998	Satellite positioning system development	Furuno, JRC
4	Biometrics	1998 ～ 1999	Image processing software development	Toshiba, Panasonic
5	security	1999 ～ 2000	Licensing of security product	TransCosmos
6	Cell phone	2002 ～ 2007	Image compression software licencing for cell phone	Kyocera communication
7	Image processing	2006 ～ 2007	OCR software development for bar code reader	Ricoh

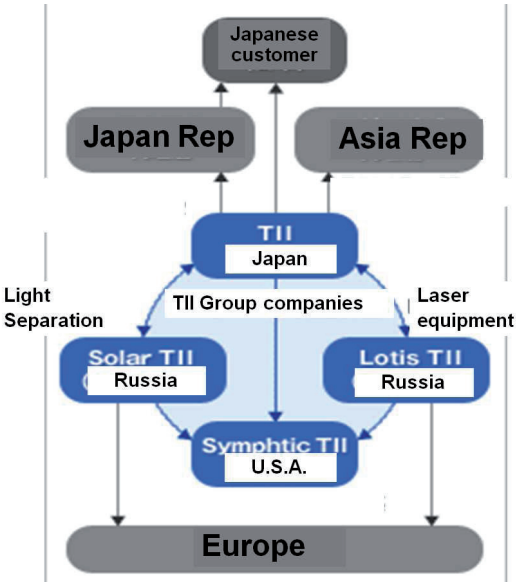
In 1999, SPIRIT also created a sister company, Seestorm; it spun off from SPIRIT as an image processing company and provided mobile embedded technology to Kyocera Communication in Japan. Each of these companies, SPIRIT and Seestorm focused on the unique use of Russian assets. Seestorm has used traditional facial-recognition security technology to develop consumer-oriented computer-vision algorithms. Soon after spinning off from its parent, Kyocera Communication licensed this Russian image-

processing engine and carried out site management for cellular phone companies. Many other Japanese companies in the cellular phone business are also showing interest in Russian computer-vision algorithms

(2)Case of Nanotechnology

In 1981, just before SPIRIT was formed, the 31-year-old sales director of a technology firm launched Tokyo Instruments, Inc. (TII), a Japanese venture focused on business with Russia, Belarus, and Lithuania. TIIs organization shows the collaboration structure with Russia (Figure 11).

Figure 11 TII Website Showing Collaboration Structure with Russia



Source: TII Website accessed on Nov. 2006

In May 1992, TII launched business with CIS for the commercialization of measurement instruments using optical lasers. The president, Mr. Suruga, saw a television program on winter in Moscow and had decided to visit. Later he establish two joint venture companies and became the Japanese side actor. In the interview with Mr. Suruga, dated 2004, he recountes, “I was impressed by the technological potential of Russia, and shocked by the

poverty in that country."

TII is extremely successful and it won many awards in laser technology and nano science. TII has various publications in the industry to present the breakthrough technology as well as set industry standards.

Among TII's engineers, more than 30% are Russian. TII brings Russian engineers and their family to reside in Japan, and has experience in overcoming the language and cultural gaps to create a comfortable environment for the Russian engineers and their families. TII took a typical Japanese style approach by renting an apartment building and paying one third of the rent for families so that they can live and together. On the other hand, TII makes the children take Russian language lessons once a week, to keep up with their mother culture. TII is one of the most valuable examples of Russian-Japanese business collaboration.

(3) Implications of the Cases of SPIRIT and TII

As actors and innovators, SPIRIT and TII have made inroads into the Japanese market for more than a decade and successfully transferred Russian technologies in aerospace, laser optics, IT, and other fields. In doing so,

they have also identified valuable technological seeds in Russia. Both companies recruited talented people from the national research institutes and university laboratories after the Soviet Union collapsed, and both concentrated on the development of industrial products.

SPIRIT and TII introduced technological seeds from Russia with a primary focus on converting basic technology. To facilitate the introduction and conversion, SPIRIT compiled a yearbook of software businesses in Russia, one of the first databases of Russian intellectual resources. The yearbook was the first trial in Russian which externalized knowledge tend to be hidden in the culture. This pioneer of Russian venture business has since grown into a major company with clients in more than 50 nations worldwide.

In Japan, government had no leeway to maneuver Russian business. Japanese companies transferred Russian technologies in the form minor ventures. In both the cases of SPIRIT and TII, the style of transfer was quite unlike that practiced in Western governments, which was under strong leadership by government and rather top-down (Laurance 1995). In Japan, most were spin-off ventures or small and medium-sized enterprises that led Russian technology transfer and they strongly required innovation.

Companies with a strong venture spirit and innovative minds performed an important role in Russian technology conversions, though they were small-scale while Western type civil to defense conversions were performed by large companies, with government leadership.

(4) Fusion of Russian and Japanese Technology

SPIRIT and TII created a unique fusion of Russian and Japanese technology, because ideas for both SPIRIT and TII products came from the basic research originated from former Soviet and the actual product implementation was done in Japan. It was the process of knowledge transfer started as the formation of the transfer seed to ramp-up, and integration (Szulanski 1999).

As an island country in the Far East, the Japanese tend to be isolated and out of the international trend of out-sourcing The situation is similar in Russia, and Russians are said to be hard to share knowledge with foreigners (Michailova 2004). Knowledge sharing and national culture is closely related. But by combining ideas from outside, Japan and Russia have the potential to create unique and useful products. Industrial countries' expertise lies in the talent to create consumer products. For example,

Japanese uses Russian ideas to create electronics products. The Japanese excel in the making of such products and its electronic appliances have flooded the world, creating a whole sector of successful digital electronics.

Russian accumulation of basic research can be a treasure house of new product ideas. There are other useful technical resources that work well in combination with Japanese products. Besides optical and mathematical processing, examples include aviation, space, atomic energy, biology, pharmacy, and nanotechnology. These elemental technologies are quite useful for speeding up and shortening the new product development cycle. In terms of product innovation these are promising technologies. By paying attention to such potential technologies, industrial countries can bring in the creativity and elucidation of a breakthrough, which will be necessary for company activities of the next generation.

4. Discussion

This section discusses, analyzes and verifies the model of the dual core actors, which is proposed in the previous section.

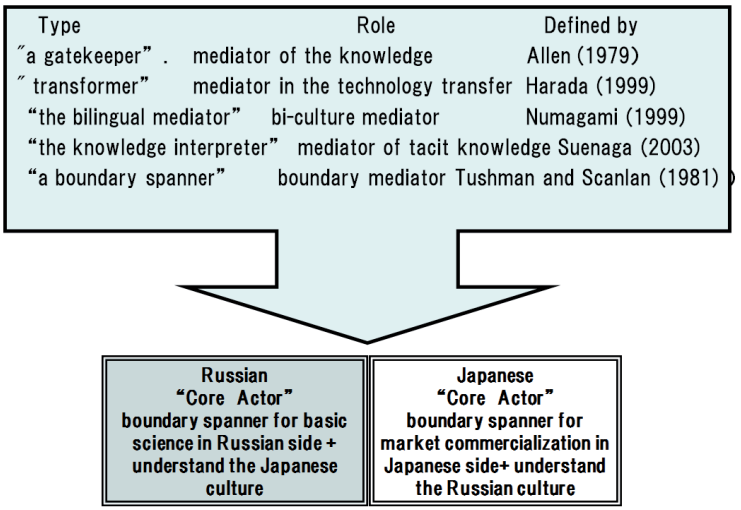
4.1 **“Dual Core”Actors as Knowledge Transformers**

As discussed in the previous section, actors transmit and enhance cross cultural communication. There has been some discussion about the roles and definitions of such actors (Figure 12).

Allen (1979) points out that the existence of the knowledge mediator is effective, and he names the mediator as “a gatekeeper”. Harada (1999) proposes the concept of “the knowledge transformer”, and Numagami (1999) introduces “the bilingual mediator” in the technology transfer. Such transformers or mediators understand both research and development. More specifically, Suenaga (2003) calls such person “the knowledge interpreter”, who translates not only the explicit knowledge but also the tacit knowledge not expressed by the language. Tushman and Scanlan (1981)

define the existence of “a boundary spanner”. All these personnel act as knowledge brokers who transmit knowledge.

Figure 12 Qualification of “Dual Core”Actors



For the cross-cultural knowledge transfer, such a brokerage agent is necessary. As the necessary condition of such person’s capability, Aonuma (1982) points out the factors below: 1.Understanding the characteristics of one’s own country culture objectively, 2. Knowledge of the culture of a partner, and a positive attitude toward cross-

cultural understanding, and 3. Knowledge and skill related to the business of the cross-cultural interchange.

However, there are few studies about the mechanism of such actors in organization. Krogh, Ichijo, and Nonaka （2000） insist on the formation of a "micro-community of knowledge" to increase the productivity of knowledge creation, and call actors within that microcommunity) “knowledge enablers”. Carlile (2004) investigates how mismatched relations between actors arise that lead to negative outcomes and insists on the necessity of “boundary object” as a mediator. Bathelt, Malmberg and Maskell (2004)investigate the effective process of the cross-cultural knowledge creation. According to them, it is necessary to build the network including both sender and receiver, which is called "a pipeline" between the knowledge mediation personnel. The “Dual Core” Actors Model supports the idea of Bathelt, Malmberg and Maskell (2004) and advances its mechanism.

4.2 Roles of “Dual Core” Actors

In the product development, one of the difficulties of the knowledge transfer is that there are communication gaps

between the basic science and business activities. While the basic science studies a natural phenomenon, the business is focusing on a market and a customer. In addition, there are cross-cultural obstruction factors such as language differences or translation mistakes. Besides, there is the tacit knowledge that is hard to communicate.

Table 7 **Transfer of Tacit Knowledge by Actors**

Type of Knowledge (tacit)	Description	Russian (basic science)	Japanese (product)
Process Knowledge	Know how and skills which are unable to be expressed by words	Experiment measure	Manufacturing process
Meta Knowledge	Mental image not expressed by words	Organization of research team	Training of technician
Object Knowledge	Object not expressed by words, Object not recognized by sense, principles already exist in nature	Discovery of self-evident truth	Knowledge of material treatment
Practice Knowledge	Only attained by doing	Fill the gap between the theory and result	Experience, impulse

As Polanyi (1966) points out, there are two types of the knowledge, i.e., "tacit knowledge" and " explicit knowledge". Explicit knowledge is common, self-evident

knowledge. Tacit knowledge is the knowledge that cannot be coded or formatted. Tacit knowledge is not expressed by the language, and is hard to convey, transfer, or communicate. However, this tacit knowledge plays critical roles in communication, especially when it is related to insight, culture, value, and decision-making perspectives (Table 7). This is one of the reasons that translation or interpretation of knowledge becomes difficult. This tacit cultural difference is not translated by the language. Therefore, translating is one role of an actor who successfully achieves knowledge communication.

Table 8 Knowledge Transfer Between Actors

Knowledge transfer object	Russian (Seeds) Basic science, R&D	Japanese (Needs) Engineering technology applied product manufacturing
Types of knowledge	Orientation toward needs	Orientation toward to seeds
Content of knowledge	Reproductive, logical rigid nature	Problem solving, cost, safety, quality, convenience
Procedure	Openness to the market needs, access to company and end users direct communication with the society	Participate in the academic society, educate scholar about the market needs

Actors on both sides make efforts to communicate tacit knowledge which is indispensable for the success of project (Table 8). Tacit knowledge must be accounted for when transmitting knowledge between different cultures and languages. The cross-cultural communication of tacit knowledge becomes more difficult in international communication. This is the reason that we need actors such as the dual core actors.

4.3 Driving Force of Cross-Cultural Communication and Management

The dual core actor should be one of a pair of actors, who exist on both sides as both senders and receivers. The dual core actor is a talented person with understanding of the technology and the products as well as market needs. He or she plays a role of "gatekeeper" and "transformer" as well as “bilingual" that understands cross-cultures. The dual core actor is the innovator and the driving force of the cross-cultural communication and management.

Figure 13 Knowledge Creation Model of Dual Core Actors.

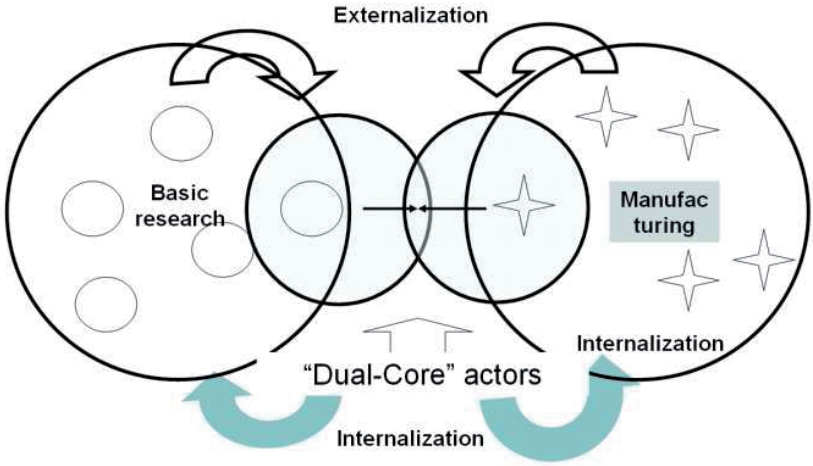


Figure 13 shows the knowledge creation model of the dual core actor. Dual core actors exist on both sides of the Russian fundamental research and the Japanese product development. A dual core actor externalizes the tacit knowledge in his or her organization to be understood and utilized by the partner organization. At the same time the dual core actor internalizes explicit knowledge that is obtained from the partner organization for the usage and creation of new knowledge. Dual core actors work in pairs, and mediate the knowledge for externalization and internalization on both sides. The dual core actor acts as a

catalyst or a mediator, and the knowledge can be externalized by the dual core actor for better understanding of the receiver. Once the knowledge is externalized, the knowledge is accumulated and internalized by the receivers so that they can use it freely. Then, the receiver becomes the sender and externalizes and sends feedbacks of the accumulated knowledge. The relationships among other senders and receivers develop effectively, through the help of the dual core actors.

The dual core actor becomes "a knowledge transformer" and a leader to coordinate and accomplish business. He or she gathers up a team to acquire new technology and products. This requires both the cross-cultural communication skill and the cross-cultural management skill. Dual core actors play the role of a catalyst for the cross-cultural connection and become intermediaries.

5. Conclusion and Recommendation

5.1 Conclusion

In this study, the model of duel core actors is proposed. The duel core actors are people who transmit

communication on both the sender side and the receiver side. They are mediators of cross-cultural communication and they fill a gap between different cultures. To verify this model, analysis of case studies of the cross cultural knowledge transfer between Japan and Russia is presented. Then, the model is tested by the survey regarding 52 cases of knowledge transfer from Russian fundamental research to Japanese manufacturers.

The theoretical contribution of this study is the identification of the dual core actors. The importance of the dual core actors is not indicated in prior research by predecessors. This study has shown that dual core actors are definitely necessary. It is especially true in remote cross-cultural communication such as that between Japan and Russia as well as between the fundamental research and product development. Thus, it is indispensable to have dual core actors who understand needs on both sides of a project.

5.2 Recommendation

The further agenda is to investigate the features and characteristics of such dual core actors, as well as the combination of what kind of actors are most desirable

internationally. In addition, it is necessary to bring up and train dual core actors as human resources in the organization. To be able to do so, it is indispensable to provide organizational support for the activity of the duel core actors. To promote motivation of core actors, it is necessary to regard the task as the duty and mission of an entire company. The task of dual core actors has to be promoted as being of critical importance for the survival of companies. The support and consciousness of the top management is required in order for a company to have such understanding.

References

Adams, J. S., B. M. Staw. and L. L. Cummings ed. (1980) "Interorganizational Processes and Organization Boundary Activities," *Research in Organizational Behavior*, Vol.2, pp.321-355.

Allen, T. J. (1979) *Managing the Flow of Technology*, MIT Press.

Aonuma, H. (1982) "A road to an international businessman," *World politics and economics*, Vol. 79, pp.63-82.

Barney, J. (1991) "Firm Resources and Sustained Competitive Advantage," *Journal of Management*, Vol. 17, No. 1, pp.99-120.

Bathelt, H., A. Malmberg and P. Maskell (2004) "Clusters and knowledge: local buzz, global pipelines and the process of knowledge creation," *Progress in Human Geography*, Vol. 28, No. 1, pp.31-56.

BowWave Technologies (2002) "Commercializing Russian Technologies: Creating Opportunities through an International Technology Business Accelerator," *BowWave Whitepaper*, Cleveland, Ohio Rev. B available at: http//:BowWave.org.

Bzhilianskaya, L.Y. (2001) “Russian Technology and

Highly Educated Personnel on the Modern American Market," Proceedings; Technology and Society

Carlile, P. R. (2004) "Transferring, translating, and transforming: An Integrative Framework for Managing Knowledge Across Boundaries," *Organization Science*, Vol. 15, No.5, pp. 555-568.

Chesbrough, H. W. (2003) *Open Innovation: The New Imperative for Creating and Profiting from Technology*, Harvard Business School Press.

Drucker, P. F. (1993) *Post-Capitalist Society* Harper Business. New York,

Elenkov, D. S. (1998) "Can American Management Concepts Work in Russia? A Cross-Cultural Comparative Study," *California Management Review*, Vol. 40, No. 4, pp.133-156.

Engelhard, J. and J. Nagele(2003) "Organizational learning in subsidiaries of multinational companies in Russia," *Journal of World Business*, Vol. 38, pp.262-277.

Furuta, A. et al. (1996) *Cross-cultural communicatio*n, Yuhikaku.

Goc, M. L. (2002) *Development Techniques for International Technology Transfer*, Quorum Books, Westport CT, p184.

Gopalakrishnan, S. and M. D. Santoro (2004) "Distinguishing Between Knowledge Transfer and Technology Transfer Activities: The Role of Key Organizational Factors," *IEEE TRANSACTIONS ENGINEERING MANAGEMENT*, Vol.51, No.1, pp.57-68.

Hakamada, S. (2002) *Reading modern Russia*, Shikuma-shinsho.

Hall, E. T. (1976) *Beyond Culture*, Doubleday.

Hamel, G. and C. K. Prahalad (1990) *The Core Competence of the Corporation*, Springer Berlin Heidelberg.

Harada, (1999) "Communication flow in a research and development organization," *Organizational Science (Soshiki Kagaku)*, Vol.32, No.2, pp.78-96.

Harris, P. R. and R. T. Moran (1979) *Managing Cultural differences*, Gulf Publishing Co.

Hofstede, G. and M. H. Bond (1984) "Hofstede's culture dimensions," *Journal of Cross-Cultural Psychology*, Vol.15, No.4, pp.417-433.

Holden, N. (2002) *Cross-cultural Management: A Knowledge Management Perspective*, Financial Times Prentice Hall.

Holden, N. and C. Tansley (2007) "Culturally distinctive manifestations in international Knowledge

Management: a historical perspective," *International Journal of Advanced Media and communication*, Vol.1 No.4 pp.313-327.

IMF, "World Economic Outlook April (2007)" http://www.imf.org/external/pubs/ft/weo/2007/01/ Accessed on August.

International Bank for Reconstruction and Development (2006).

Krogh, Georg Von, K. Ichijo and I. Nonaka （2000） *Enabling Knowledge Creation: How to Unlock the Mystery of Tacit Knowledge and Release the Power of Innovation*, Oxford University Press

Kobayashi, T. (2005) *The succession and technology transfer- the Japanese real ability*, Shibunkaku.

Leavitt, Harold. (1951) "Some Effects of Certain Communication Patterns on Group Performance". *Journal of Abnormal and Social Psychology*, Vol.46, pp. 38-50.

Laurance, E. J. and H. Wulf, (1995)"Conversion and the integration of economic and security dimensions," Report of Bonn International Center for Conversion

Michailova, S. and K. Hutchings (2004) "Knowledge Sharing and National Culture: A Comparison Between China and Russia," *CKG Working Paper*, No.

13

Nonaka, I. & H Takeuchi (1995) *The Knowledge Creating Compan*y, Oxford University Press

Nugamagami, M.(1999) *History of innovation of a liquid crystal display*, Hakuto-shobo.

Polanyi, M. (1966) *The Tacit Dimension*, London: Routledge & Kegan Paul.

Porter, M. E. (1985) *Competitive Advantag*e, Free Press.

Powell, W. and S. Grodal, et.al. (2005) *Networks of Innovators*, The Oxford Handbook of Innovation, Oxford University Press, pp.56-85.

Saito, Y. (1979) *Technology Transfer Theory*, Bunshindo.

Samovar, L. A., R. Porter and N. Jain (1981) *Understanding Intercultural Communication*, Wadsworth.

Schumacher, E. F. (1973) *Small is Beautiful: Economics as if People Really Mattered*, Blood&Briggs London.

Statistics Bureau of General Affairs Ministry (2004) "Technology study investigation report," www.meti.go.jp/policy/tech_research/.

Suenaga, S. (2003)"Role of a knowledge interpreter in a policy process," Ph.D. dissertation, Japan Advanced Institute of Science and Technology.

Szulanski,G. (1999)"The Process Of Knowledge

Transfer: A Diachronic Analysis Of Stickiness," OBHDP, special issue on Knowledge Transfer.

TechEncyclopedia (2009) accessed : www.pcmag.com/encyclopedia_term/.

Trompenaars, F. and P. Woolliams (2005) *Business Across Cultures*, lavoisier.fr.

Tushman, M. L. (1977) "Special Boundary Roles In The Innovation Process," *Administrative Science Quarterly*, Vol.22, pp.587-605.

Tushman, M. L. and T. J. Scanlan (1981) "Boundary Spanning Individuals: Their Role in Information Transfer and Their Antecedents," *The Academy of Management Journal*, Vol. 24, No. 2, pp. 289-305.

UBS Warburg, Brunswick Warburg Aberdeen Group and Pettily Rabin Todd & McGrath (2002) http://www.stat.go.jp/data/sekai/02.htm

Yamaguchi, E. et al. (2000) "Social condition of technology creation," *Organizational Science(Soshiki Kagaku)* , Vol.34, No.1, pp.30-44.

Yashiro, H. (2004)"Successful Collaboration Model of Japan and Russia," INNOVATION and ENTREPRENEURSHIP for SUSTAINABLE DEVELOPMENT Vol.2, IEEE IEMC, Oct., pp.723-728.

Zander, U. and B. Kogut (1995) "Knowledge and the Speed of the transfer and Imitation of Organizational Capabilities: An Empirical Test," *Organizational Science*, Vol.6, No.1, pp.76-92.