

Article

## ***International Group Innovation: Empirical Analysis***

Yukio TAKAGAKI

### **Abstract**

This paper is the part 2 (the empirical analysis) of Takagaki (2021) on researching Group Innovation. Both parts attempts to clarify the mechanism that can explain innovation among international businesses.

As a framework for analysis of international business, used here, is “*Dynamic OLI Cycle*,” (Takagaki, 2019a). This modification model is based on the “*OLI Paradigm*” (Dunning, 1979), which is often used in empirical research of MNEs (multinational enterprises). The use of the “*Dynamic OLI Cycle*” enables analysis of innovation in various types of foreign operation, not limited to the manufacturing industry. In Takagaki (2021), referring to current international trends, we explain the necessity of “*Dynamic OLI Cycle*,” which is modified version of “*OLI Paradigm*.”

In domestic group innovation, Takagaki (2017) focused on the four factors of “*funding*” and “*trust*” in addition to “*place*” and “*leadership*,” which is named as the “*OPTIL paradigm*”.

Based on our previous investigation of innovation among SMEs (small and medium-sized enterprises) in the Tokyo metropolitan area, we expect it is possible to expand the scope of group innovation to international business. By combining the above two models, we clarify a research method of the international innovation model and propose possible hypotheses.

**Key words:** Innovation among international businesses, Dynamic OLI Cycle, Group open innovation, OPTIL paradigm

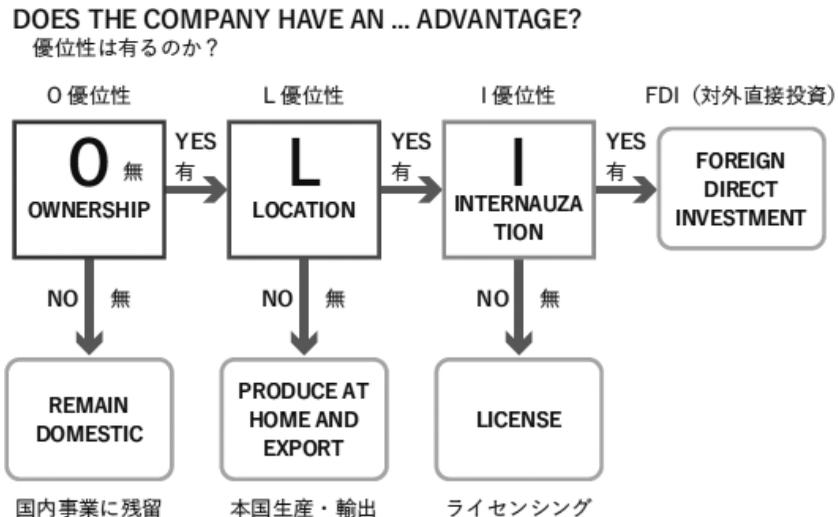
## 1. The mechanism of international group innovation

The concept of mechanism on international group innovation can be explained by combination of two models: “*Dynamic OLI Cycle*” and “*OPTIL paradigm*”. Although this mechanism was introduced in Takagaki (2021), for the purpose of well understanding, we will explain as follows.

### 1.1 Dynamic OLI Cycle

For international business analysis, “*Dynamic OLI Cycle*” (Takagaki, 2019a) is used. This modification model is based on the “*OLI Paradigm*” (Dunning, 1979) as shown in Figure 1, which is often used in empirical research of MNEs (multinational enterprises).

The use of the “*Dynamic OLI Cycle*” (Table 1) enables analysis of innovation in various types of foreign operation, not limited to the manufacturing industry. In Takagaki (2021), referring to current international trends (Takagaki, 2013, 2018), we explain the necessity of “*Dynamic OLI Cycle*,”



Source: Author's modification based on Root (1982, 1984)

Figure 1 How to Enter International Business and OLI Paradigm

Table 1 Concepts of Dynamic OLI Cycle

<ol style="list-style-type: none"><li>(1) <u>Ownership Advantage</u> may not necessarily be own.</li><li>(2) <u>Internalization Advantage</u> is considered to define not only FDI but also entry mode.</li><li>(3) <u>Location Advantage</u> is considered in combination with the superiority of ownership.</li><li>(4) Add the concept of resource-based perspective (RBV) and <u>dynamic capability</u> to <u>Ownership Advantage</u>.</li><li>(5) The consideration of “O to I to L” may be started from anywhere in the three elements, it is sufficient to consider the three elements.</li><li>(6) The consideration of “O to I to L” will not only be considered when entering the market, but will continue to be subject to review it after entering the market. “O to I to L” may be referred to as a <u>cycle</u>.</li><li>(7) The consideration of “O to I to L” is considered organically with other regions, not just the countries in which the country is eligible for the expansion.</li></ol>
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Source: Takagaki (2019a)

which is modified version of “*OLI Paradigm*.”

In particular among MNEs, BCG (Born Global Company) will be the main subject of discussion. The company’s size is small, and it demonstrates its international competitive power and is internationalized within a short period of time. Even if it is not internationalized at present, Active startup-company and SMEs such as Unicorn companies are also included in discussion, because they may internationalize sooner or later.

BGC’s management resources are mainly based on the personal knowledge and experience of its founder and members. There are many insufficient resources for start-up faze, and they may try to get from others by making full use of personal networks. Key issue is to identify what kind of information and knowledge is necessary and what management resources are incorporated into the international business.

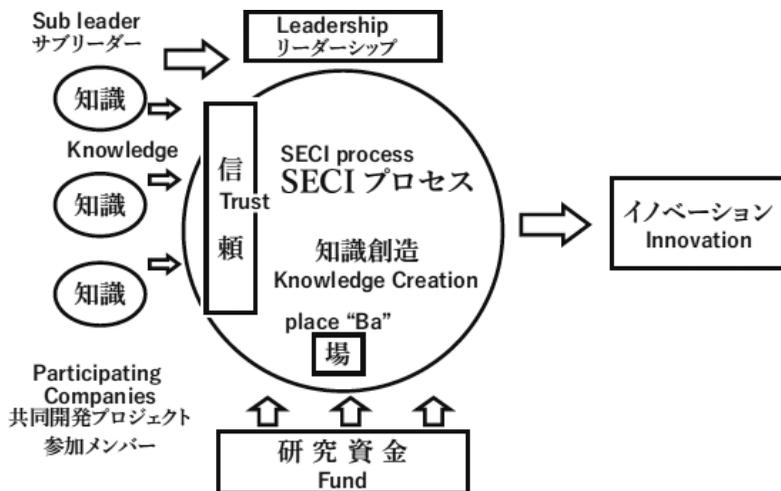
“*Dynamic Capability*” introduced by Teece (2009, 2014) should be understood as a relocation of management resources within a company, as well as the availability of external management resources. “*Resource relocation*” is a major challenge for small international organizations.

Hennart (2009) introduced the concept of “*CLAs (Complete Local Assets)*”. Emphasize that in the overseas operations of MNEs, their management resources (FSAs: Firm-specific-advantages) are combined with their own, if not owned. It is called the “*Banding Model*”. FSAs are knowledge resources in a broad sense that give companies a competitive advantage over ideas, different types of information, and new products, production processes, and management technologies. On the other hand, CLAs refer to information on land, labor force, distribution network, local market, etc. The *Banding Model* is based on the fact that these FSAs and CLAs link MNEs to realize overseas operations. The starting point of this model is close to Dunning’s OLI paradigm, which presents a combination of ownership and location advantages. CLAs assume management resources owned by specific local partners. Not only CLA belong to other companies, but it can be said that it is the entrepreneurial spirit of the management to plan and execute these combinations.

## 1.2 OPTIL paradigm

Open innovation in SMEs is discussed in Himmelberg and Petersen (1994), Lichtenthaler (2011), van der Meer (2007) and Reuter (1977). Based on our previous investigation (Takagaki, 2014, 2015, 2016) among SMEs (small and medium-sized enterprises) in the Tokyo metropolitan area, four success factors for limited open innovation have been pointed out in Takagaki (2017). Four success factors are called the “*OPTIL paradigm*” including funding, place, leadership, and trust as shown in Figure 2.

As shown in Figure 2, joint research project is supported by research funding. The knowledge of the participating companies is put into the joint research project under the sub-leaders of each company. Under the leadership of the entire project, the SECI process (Nonaka and Konno, 1989) functions in a common place and knowledge creation is carried out. It is repeated many times that the sub-theme is taken back to the participating companies, knowledge creation is carried out within each company, and it is again and



Source: author

Figure 2 The concept of OPTIL

again taken into a common place. It shows that open innovation will take place through such a process.

We expect similar patterns to have occurred in international business. By combining the above two models, we clarify a research method of the international innovation model and propose possible hypotheses later.

### 1.3 Combination of two models

The “*OPTIL paradigm*” originally targets cooperative innovation among several SMEs, but it is assumed that the same can be said among international organizations. In innovation between different companies, there are “*Boundaries of Firm*” within the group. In international group innovation, there are more difficulties caused by “*Boundaries of Nations*”.

Because of this, among the four success factors, the importance of “*trust*” may increase, so we will take it up further deepen the discussions so far. It has been verified that “*trust*” is a success factor of innovation (joint research projects, etc.), but considering innovation in chronological order, we confirm

that “*trust*” is a success factor before, during, and after implementation. In addition, from an organizational level perspective, we confirm that “*trust*” is a success factor among individuals, groups organizations, and member companies. Since it has been confirmed (Takagaki, 2019b) among SMEs in Japan, we will shift our attention to the trust between internationals.

## 2. Several arguments on Trust

### 2.1 Discussion of trust in previous research

Although trust is invisible, innovation through joint projects require stronger ties than any other relationship. However, there are many definitions of “*trust*” from the different perception. The meaning of trust in English is an exclusive and multifaceted matter (Corazzini, 1977), and there is a mutual relationship, and it is difficult to understand individually. Moreover, it is not required interdependence or constant (Tyler and Stanley, 2007). Individual diversity is the basis of various different arguments (Coleman, 1990; Deutsch, 1960; Gambetta, 1988; Hart et al., 1986). Swan and Trawic (1987) present five conceptual frameworks: dependency, honesty, ability, customer orientation, and kindness. There are many other discussions (Shamah and Elsawaby, 2014). There are different ways of thinking not only about definitions but also in concepts and positioning. Japanese “trust (*shinrai*)” is also a commonly used word and has a different definition in each field. Yamagishi (1998, pp. 11–12) points out that “trust” is polygamous and studied in many academic fields, but in fact, the definition is different for each field or researcher, and the concept of trust is distinguished from “reliability”, which is a characteristic of the trusted side, and “trust” is arranged in detail. However, it is a classification from the viewpoint of psychology. In this context, the definition of “voluntary behavior based on the expectation that other groups will do some favorable action against their own group, fragile, but not to the ability to monitor and manage other groups” (Mayer, 2008) is easy to understand, and “people can trust others, individual. It is easy to understand the point that” Dunning et al. (2012, p. 687) that “because it can enjoy the

benefit which cannot be created by this” is well understood.

## **2.2 Definition of Trust**

The “*trust*” has already been discussed in the business relation (Sako, 1992). Manabe and Nobeoka (2003) stated that trust is essential in cases with some risk or in an environment with high uncertainty, and the role of trust is listed according to the context, but among them, items related to (1) joint research contribute to the establishment and continuity of business-to-business relationships, (2) transaction costs caused by contracts are reduced, (3) promote the realization of joint learning between companies and knowledge creation by joint project, (4) cooperative relationships are created, and effective problem solving can be carried out jointly. For these reasons, trust is defined as “a mutual relationship in which participants do not take any opportunistic actions and maintain a situation in which goal of development are carried out.”

## **2.3 Project progression and trust within individual companies**

Considering the joint project at the time series level, it is necessary to consider “trust” in accordance with the steps before starting, execution, and completion of the project. Among them, it is also necessary to think about the organizational level of trust, divided into individuals, teams, organizations, and joint projects and member companies. In addition, it is necessary to discuss in detail the “trust” in the organizations within each member company in the participating companies in the joint project. As a viewpoint at the time series level, in the questionnaire (& interview) survey reported in Takagaki (2017), questions at each stage are asked from such an idea.

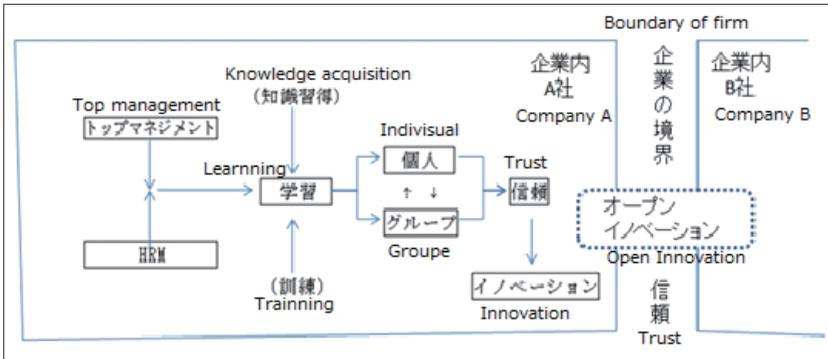
## **2.4 Trust in OPTIL Paradigm**

Fulmer and Gelfand (2012) propose the organizational level of trust and introduce it in Table 2. The three levels of trust are shown: individual, team, and organization. In the case of open innovation, trust between companies is

Table 2 Level of trust and instructions

Level of trust and instructions	
Level	instruction
Individuals	Individual each other
Team	Team
Organized	Organization

Source: Fulmer and Gelfand (2012)



Source: Created by the author

Figure 3 Innovation within individual organizations

essential.

As indicated in Figure 3, the organizations are participating in joint projects. Although the situation in the company before the project participation is shown, it is an individual enterprise that actually performs the development work according to the progress of the project, and it is thought that trust is further formed in that.

In addition, innovation in individual companies is shown in Figure 3.

In Figure 3, human resource management (HRM) of employees is carried out under top management in the company (Company A). Especially, the learning is done by the knowledge acquisition and the training, and a new knowledge creation happens here. As shown in Table 2 and Figure 2, knowledge creation is expressed in the SECI, and occurs in the field under the

leader. Knowledge creation occurs at the individual level, at the group level, and at the organizational level within the company. In this process, mutual trust is essential. So far, the same is the case with closed innovation.

In addition, open innovation is carried out in collaboration with other companies (Company B). In the company B expressed on the right side, the same thing as company A on the left is happening, as a lever it is not written in detail, and knowledge will pass the boundary between company A and Company B. Trust between companies is indispensable here, and it is a premise that innovation between multiple companies occurs. The knowledge of Company A enters into Company B, and the knowledge of Company B enters company A, and knowledge creation in each company is carried out.

### **3. Hypotheses and OPTIL for international business**

#### **3.1 Open innovation Hypotheses**

Although four hypotheses (Investment Fund, Place, Leadership, and Trust) in limited open innovation (OPTIL) have been reported (Takagaki, 2021), we will introduce the hypotheses to be confirmed in verifying four success factors for the project in an international joint development project.

H<sub>F</sub>: Investment *funds* influence innovation success

H<sub>P</sub>: *Place* influences innovation success

H<sub>L</sub>: *Leadership* influences innovation success

H<sub>T</sub>: *Trust* influences innovation success

#### **3.2 Trust Hypotheses**

Trust is major success factor in collaborative research projects. The following hypothesis is set in order to confirm the situation within the individual organization according to the time series.

##### **(1) Time Series**

H1: Before the start of the project, *trust* in partner companies is a success

factor

H2: During the execution of the project, *trust* in partner companies is a success factor

H3: After the project is completed, *trust* in partner companies is a success factor

## (2) Organization Level

H4: *trust* at the individual level is a success factor

H5: *trust* at the team level is a success factor

H6: *trust* at the organizational level of the enterprise is a success factor

H7: *trust* at the organizational level of joint projects is a success factor

## 4. Verifications of hypotheses

### 4.1 Verification of open innovation hypotheses

The result of questionnaire survey in domestic SMEs was reported in Takagaki (2017), and we will introduce here for better understanding. Survey was conducted in 2016 for manufacturing companies (about 270 companies) and subsidized enterprises (within the Kanto Bureau of Economy: about 80 companies) among TAMA association member companies in the Tokyo metropolitan area. We will analyze and discuss in detail the four factors (Table 3) that affect, especially those related to “trust”.

Among the four factors, it can be confirmed that the impact of “(1) research funds”, “(3) leadership”, and “(4) confidence” is large. Regarding

**Table 3 Four influencing factors**

	(1) Funding	(2) Place	(3) Leadership	(4) Trust
1. Very impact	19	6	21	<b>38</b>
2. A little impact	24	11	21	13
3. Not much impact	15	24	17	10
4. Not affect at all	6	25	9	7

Note: the unit is “number of cases”.

“(2) place”, there are less influences in the result of the questionnaire. In this regard, in the interview, we obtained an explanation that they answered that there was no impact because they used the facilities of their company.

The open innovation Hypotheses are verified as follows.

H<sub>F</sub>: Investment *funds* influence innovation success

H<sub>P</sub>: *Place* influences innovation success

H<sub>L</sub>: *Leadership* influences innovation success

H<sub>T</sub>: *Trust* influences innovation success

All the presidents of interview companies have stated that “trust” is the most important factor in promoting the project among the four factors.

#### 4.2 Verification of trust hypotheses by questionnaire

The “trust hypotheses” have also been verified from the same questionnaire survey and interview survey in Takagaki (2019b).

##### (1) Time Series

Time series hypotheses are verified as follows.

#### **H1: Before the start of the project, *trust* in partner companies is a success factor**

In the questionnaire, the factors affecting the cooperation before decision-making were asked, and before the implementation, “1. Future markets and expected profit” (51 cases), “3. Trust in partners” (41 cases), and “6. Social Sense of Mission” (19 cases), “2. (17 projects). In the questionnaire survey (Question 8: Open Answer), there was a contract making that placed the highest priority on trust, (1) clearly stated in the contract in advance, and (2) as a relation to the sense of trust in the solution of the inhibitor. In the interview, there were many opinions that, as the progress of research results progressed, but also by daily communication, enthusiasm for initiatives, and

demonstrating leadership, as well as progress of research results, there were many opinions that they would be strengthened.

**H2:** During the execution of the project, *trust* in partner companies is a success factor

From the viewpoint of the change from before the implementation to the implementation, it is considered that the problem becomes actual or cancels as an inhibitor. In the questionnaire result, it is considered that the contribution degree becomes apparent even if there is a trust relationship of the difference between the sense of trust and the contribution level for the partner. “Confidence in leadership” is not a major alienation requirement.

**H3:** After the project is completed, *trust* in partner companies is a success factor

Overcoming the alienation factor by “confidence”, “2. Differences in intentions between partners” (52 cases), “3. Differences in contribution between partners” (24 cases), “6. It is said that it has the effect on “19 cases of unfairness of future expected profit” (19 cases), “1. Depletion of R&D funds” (18 cases). There is also a company (Company D) that has set “trust” as its management philosophy on HP. In order to form a sense of trust, it is easy to form a relationship of trust when it is an old-fashioned company, such as having a business relationship before the start of the project, but it is a sufficient condition and not a necessary condition. In addition, when choosing a partner, consider the results of the company, the personality of the manager, etc.

## (2) Organization Level

Organization level hypotheses are verified as follows.

**H4:** *trust* at the individual level is a success factor

In the questionnaire survey (Question 8: open answer), the sense of trust could not be continued (3) There was also a change in the part-nurse in the

middle.

**H5: *trust*** at the team level is a success factor

In the questionnaire survey (Question 8: Open answer), (1) there was no need for connoisseurs to divide work, and (2) the efforts of coordinators (= leaders) were necessary to restore the confidence of partners (= members).

**H6: *trust*** at the organizational level within the enterprise is a success factor

In the questionnaire survey (Question 8: Open Answer), (1) regular plenary meetings (progress, technology), (progress, technology), (2) reporting and exchange of opinions, (3) improvement of systems such as the wheel number system, (4) information disclosure, (5) walk-through (confirmation by patrol), (6) essential technical discussions. (7) There is also the utilization of CAD and the Web, and in addition, it is considered that informal relationships such as (8) technology-oriented companies gathered and developed happily, and (9) the formation and operation of “places” are also important for the formation and operation of “places”.

**H7: *trust*** at the organizational level of joint projects is a success factor

The duties of leaders in research projects are to (1) create a knowledge vision, (2) constantly redefine knowledge assets, check whether they fit the knowledge vision, (3) create “places”, energize them, connect multiple “places”, and (4) lead, promote, and justify the SECI process. In the joint development project, they are located in the strategic position where the flow of information of the vertical and horizontal in the organization intersects to create, nurture, and lead “place” in order to create new knowledge. In this way, it is not an exaggeration to say that it depends on the leader whether or not the SECI process functions and causes knowledge creation when a “place” is formed.

In the questionnaire survey (Question 8: Open answer), (1) there was no need for connoisseurs to divide work, and (2) the efforts of coordinators (=

leaders) were necessary to restore the confidence of partners (= members). (1) corresponds to (1) creating the knowledge vision above, and (2) constantly redefining knowledge assets. (2) corresponds to (3) connecting the “places” described above and (4) facilitating the SEC process. “Trust” was made a factor because open innovation is a development project between different companies, and “corporate boundary” exists in the project team, and it is essential to maintain the cooperative relationship of participating members.

In the questionnaire survey (Question 8: Open Answer), there was a contract making that placed the highest priority on trust, (1) clearly stated in the contract in advance, and (2) as a relation to the sense of trust in the solution of the inhibitor. In addition, there was also a change in the part-notion in the middle because the sense of trust could not be continued.

All the presidents of interview companies have stated that “trust” is the most important factor in promoting the project among the four factors.

There is also a company (Company D) that has set “trust” as its management philosophy on HP. In order to form a sense of trust, it is easy to form a relationship of trust when it is an old-fashioned company, such as having a business relationship before the start of the project, but it is a sufficient condition and not a necessary condition. In addition, there are many opinions that, in the selection of partners, companies’ achievements, management’s personalities, etc. are considered, but with the progress of development, progress of research results will be strengthened not only by daily communication, enthusiasm for initiatives, and by demonstrating leadership.

### 4.3 Verification of trust hypotheses by Case Analyses

Here, the Trust hypotheses shall be confirmed by the cases of TN and TJ.

#### (1) Company TN

In the case of Company TN, TN is a Japanese subsidiary and chemical materials manufacturing company with 50% owned by EM company, a U.S.

MNE. As for its main business field, the EM Group has a world's largest research division managing knowledge group, and there is a knowledge aggregation network of companies within the Group. TN is a member of the network. TN was founded in 1939 and became an EM subsidiary in 1949. During this case, TN's profit margin was high while maintaining companies listed on the First Section of the Tokyo Stock Exchange. TN was exploring an original new business (that EM does not have) and aimed at commercialization from the development of high-strength functional fibers with its own technology development as the core target.

By heating pitch-spun fibers, high-strength functional fibers were produced, and it was confirmed that the process was possible at the laboratory level. After heating at 500°C, high-strength fibers for the general-purpose product are heated at 2000°C, and ultra-high-strength fibers at 2500°C. The problem here was to produce a heating furnace for commercial production and to confirm that stable operation was carried out.

Heater of furnaces are supplied electricity, and heater are made of Ni-Cr for 500°C, Carbon rod for 2000°C, and Synthetic Graphite rod for 2500°C. Temperature level 2500°C means almost nuclear reactor and near melting point of Graphite (near 3000°C). Furnace developing team with furnace manufactures is organized as three temperature levels: 500°C with Japanese reasonable manufacture, 2000°C with Japanese top-ranking manufacture, and 2500°C with US manufacture. The project was successful.

## **(2) Company TJC**

TJC is TJ Group's chemical products and plastics resin division and is a top manufacturer of polycarbonate resin used in optical discs. Polycarbonate is a thermoplastic resin and used to injection molding.

TJ Group has sluggish performance eyeglass lens division of TJ Lens using thermosetting resins by casting. The company decided to enter the eyeglass lens business due to the fact that Polycarbonate eyeglass market is spreading in US market.

Since injection molding is suitable for mass production of the same shaped product. On the other hand, casting with a thermosetting resin takes time for curing, but the mold is inexpensive. It is suitable for the production of eye-ware lenses that need to prepare lenses with a wide variety of curved surfaces. Before marketing in US and Japan, There is the development of mold nesting that can mold eyeglass lenses with many varieties. Other theme is lens design such as multifocal, however soon later, TJC found good lens designer in the US. The project was successful.

### (3) Verification of two Cases

From both cases, OPTIL hypotheses and Trust hypotheses are verified.

#### Open Innovation (OPTIL) Hypothesis

H<sub>F</sub>: Investment *funds* influence innovation success

TN self-funding      TJ self-funding

H<sub>P</sub>: *Place* influences innovation success

TN OK + Furnace Company OK      TJ OK + Mold Company OK

H<sub>L</sub>: *Leadership* influences innovation success

TN OK + Furnace Company OK      TJ OK + Mold Company OK

H<sub>T</sub>: *Trust* influences innovation success

TN OK + Furnace Company OK      TJ OK + Mold Company OK

#### Trust Hypotheses

##### Time Series

H1: Before the start of the project, *trust* in partner companies is a success factor

TN OK + Furnace Company OK      TJ OK + Mold Company OK

H2: During the execution of the project, *trust* in partner companies is a success factor

TN OK + Furnace Company OK      TJ OK + Mold Company OK

H3: After the project is completed, *trust* in partner companies is a success

factor

TN OK + Furnace Company OK      TJ OK + Mold Company OK

### Organization Level

H4: *trust* at the individual level is a success factor

TN OK + Furnace Company OK      TJ OK + Mold Company OK

H5: *trust* at the team level is a success factor

TN OK + Furnace Company OK      TJ OK + Mold Company OK

H6: *trust* at the organizational level within the enterprise is a success factor

TN OK + Furnace Company OK      TJ OK + Mold Company OK

H7: *trust* at the organizational level of joint projects is a success factor

TN OK + Furnace Company OK      TJ OK + Mold Company OK

## 5. Result and Conclusion

It is called the OPTIL paradigm because it is limited open innovation. Leadership, place, and trust, and the purpose of this paper is to further take up “trust” and further deepen the discussions so far.

Although it has been verified that “trust” is a successful factor of the joint research project, considering the project in chronological order, it was confirmed that “trust” is a success factor before, during, and after implementation. In addition, from the viewpoint of the organization level, it was confirmed that “trust” was a success factor among individuals, groups, organizations, and members of companies within the enterprise. In addition, since the situation in the questionnaire survey (interview survey) that has been carried out was utilized, there are some places where it seems to receive criticism that the verification is insufficient. In the future, we would like to further reinforce these by adding interview surveys.

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