

Crowdsourcing and Quality Control : Approach from Transaction Cost

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Abstract

Crowdsourcing is a new way to order business, using crowds that appeared in recent years. Crowdsourcing is an epoch-making tool that allows orderers to select talented people in the world with the technology. They want from among many contractors and can order business. Crowdsourcing is an effective way to the benefit of contractors and can solve with the shortage of personnel that we are going to face. However, crowdsourcing has problem of quality control of products. Previous study has not said methods for quality control of project type crowdsourcing. Moreover, Japanese orderers have not been able to recognize the cause of quality control problem. So, they have not obtained high quality. In other words, Japanese companies can't use crowdsourcing. Our objective is to clarify the cause of quality control constrain of project type crowdsourcing. We follow three steps. (1) theoretical study review, (2) an interview with companies (platform, orderer, contractor), (3) questionnaire for orderer. This study will provide valuable suggestions for many people using crowdsourcing.

7607words

Keywords: crowdsourcing, transaction cost, quality control, project type

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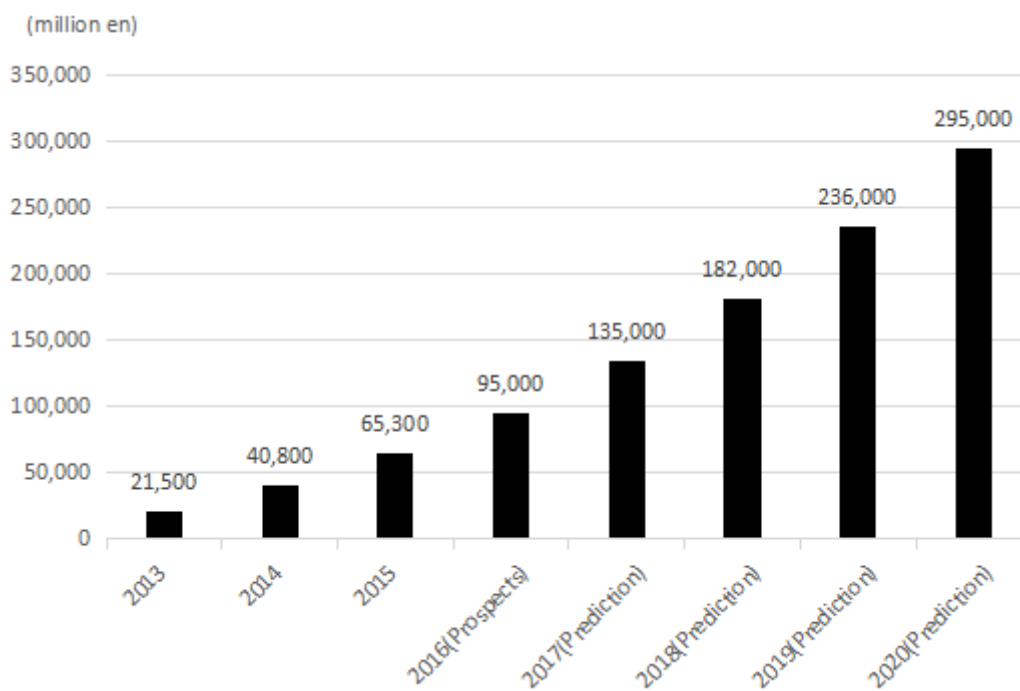
1. INTRODUCTION

In this section, first, the reason to study for crowdsourcing. Next, explain what is crowdsourcing.

1.1 Objective of This study

The purpose of this study is to enable Japanese to conduct business with overseas contractors on the web using crowdsourcing. Even without a connection, it has the merit of being able to trade with the necessary personnel. In addition, the market size of crowdsourcing is growing.

Figure 1: Market size transition and forecast of crowdsourcing services



Source: Yano Research Institute Ltd.(2016)

<https://www.yano.co.jp/press/press.php/001612>

However, most Japanese companies stay in domestic transaction, and interaction with overseas contractors has not advanced much. Specifically, companies are engaged in intermediary companies on site. In other words, it is not the original crowdsourcing.

Moreover, Japanese companies have not been able to do sufficient crowdsourcing that can be established only through Internet interaction. Why is the situation that the original crowdsourcing is not done? That is because crowdsourcing has problems of quality control. In this study, Japanese companies are aiming for dealing with overseas companies by solving the problem.

According to Baba and Kashima (2013) "One of the important tasks in crowdsourcing is quality control of products created by contractors." The orderer successfully manages the quality of products submitted by the contractor. And they make effort to make products that they expect. In crowdsourcing, it is not guaranteed that contractors have sufficient capacity to accomplish the task, then contractors are not only those with high abilities but others that are not. Furthermore, it is known that there are not a few "spam workers" that create random data only for the purpose of obtaining rewards (Kashima, Kajino, 2012). According to Baba, et al. (2014), "In the crowdsourcing, there are

variations in the quality of products made by contractors, so problem of quality control such as how to suppress variations in quality are actively researched.” In this study, we defined the problem of quality control as how to suppress the variation in the quality of the product delivered by the contractor. As described above, quality control is a problem in crowdsourcing, but in the paper, it has not been clarified where the problem is. In addition, there was no paper which touched on other problems of the quality control in crowdsourcing. Therefore, a major problem in crowdsourcing is the quality control.

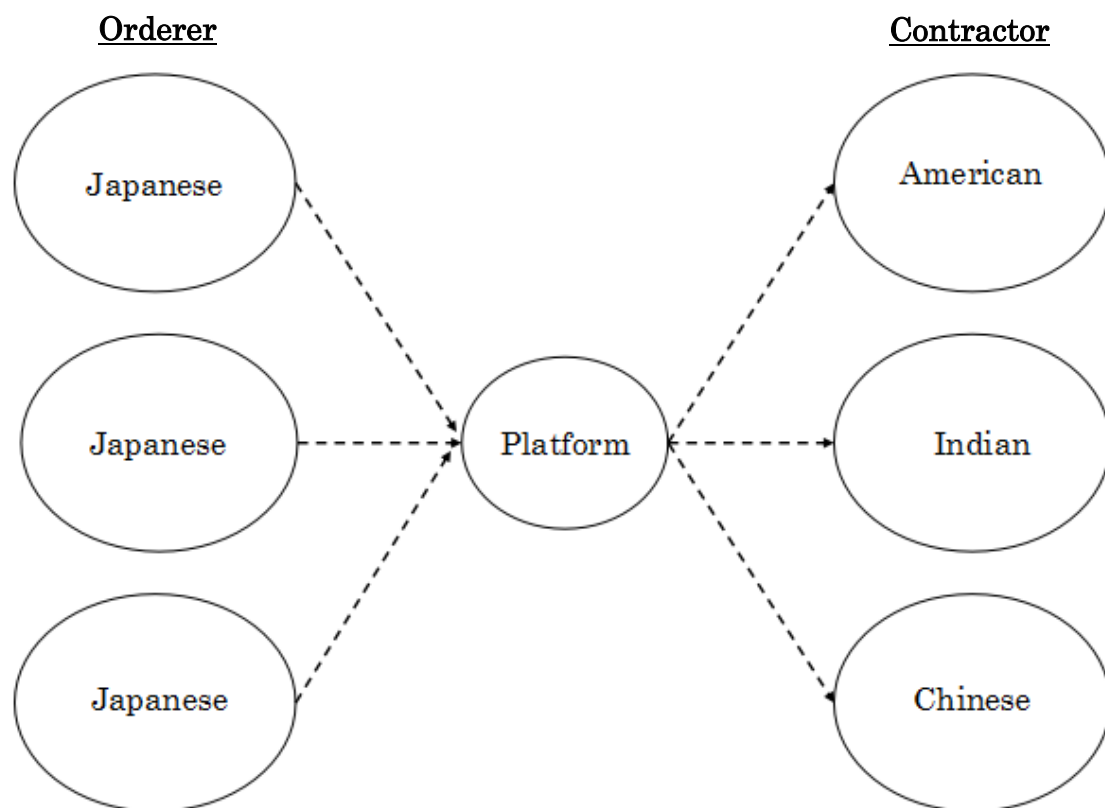
1.2 What's Crowdsourcing

From now, we will explain what crowdsourcing is. Recently, due to the spread of the Internet now, "crowdsourcing" business to outside "a large number of general people" became possible. Crowdsourcing is a term named by Jeff Howe, contributor editor of Wired magazine. According to Igawa and Higa (2013), “The crowdsourcing service is an innovative mechanism for efficiently processing tasks requiring human judgment and creativity, which is difficult with computers by asking jobs to unspecified people”. That is, it became possible to request work for unknown talented people in the crowd for work that required human skills that can't be done to computers for crowdsourcing. Of course, even Japanese can order suitable personnel all over the world, not just those who are domestic in Japan. Crowdsourcing is an innovative trading method using the Internet. Crowdsourcing consists of three standing. Orderer, who order business, contractor who

receive and complete job, and platform which make a matching place for both.

Crowdsourcing consisting of these three positions is the current mainstream.

Figure 2: Three positions of crowdsourcing



Source: Author

Also, crowdsourcing has three types, micro-task type, project type, competition type (Yoshida, 2014). In this study, we are talking about project type. Now, we explain each

type in turn. Micro-task type is the most widely used type. Micro-task type crowdsourcing is often attracted to the point that "inexpensive and massive processing is possible" due to its characteristics (Ashikawa, Kawamura, Ohsuga, 2014). First, orderer order a work to platform, contractor contract with orderer, then contractor begin the work. After completion of work, contractor submits the product. Once that is done, the contractor can receive rewards. Micro-task type is mainly used for work such as simple data input that anyone can do. For example, there are simple tasks such as writing transcripts and experiencing stories in the micro-task type. Competition type, orderer order a work platform same as micro-task type, then multiple contractors submit suitable products for their contents. The orderer selects the most suitable product from among them and pays reward to the submitter. It is mainly used for the production of logos and leaflets. Last, we explain for project type. The flow of project type is as follows. Like the previous two, orderer order a work platform, then multiple contractors submit a proposal. Orderer select and contract with a suitable contractor's proposal. After the contract, contractor begins the work. Multiple discussion is held between orderer and contractor. Reward is paid for the satisfied product. It is mainly used for web design and Software development unit price of reward is higher than others.

As mentioned above, there are three types of crowdsourcing, but in the previous study, there is no. Project type solution, and only solutions of quality control were presented only for micro-task type and competition type. For example, Ashikawa, et al. (2014) mentioned to the solution of crowdsourcing for micro-task type. That is a system that

builds a crowdsourcing system (PCSS) under a private environment and has tasks performed only by limited people (members). In this method, points that can be ordered to an unspecified number of people, which is merit of crowdsourcing, are lost. Also, Kashima (2014) mentioned to the solution of the crowdsourcing for competition type. That is a method called redundancy. Redundancy is to ask some people to do exactly the same work. Since this method requests the same job to multiple people, it is unsuitable for those with a high remuneration amount per project like project type.

As mentioned above, though solutions have been mentioned with respect to solutions of the micro-task type and the competition type, there are few papers on project type, and no solution to the problem of quality control has been presented.

Uematsu(2014) mentioned to that in the United States market which is the origin of the crowdsourcing, the use of the micro-task type accounts for the majority, whereas the project type in the crowdsourcing market in Japan is widely used. Also, Higa (2015) mentioned to that order for large-scale projects are increasing, and the number of registrants of advanced human resources is on the rise.

While expanding demand in the project type crowdsourcing in Japan, since the solution for quality control of product is not fully founded, this becomes the main objective of academic study. By solving problem in the quality control dealing in project type can lead to the utilized of crowdsourcing. Specifically, by ordering overseas, it will

be a way to solve the shortage of personnel such as it engineers shortage. And also, even without a connection people can trade with the necessary talent.

2. THEORETICAL BACKGROUND

Here we first discuss what is affection the quality control of crowdsourcing mentioned in the previous chapter. We need to have look how company control the quality of the products architecture has been developed with other partner companies. So, to explain those issues, we discuss two theories, (1) product architecture and (2) transaction cost theory.

What is affecting quality control? That is product architecture. Fujimoto et al, (2001), mentioned to have revealed product architecture may have large impact on the products. That is because it is an integrated product in particular. Therefore, the design of the interface between the orderer and contractor is very important in the project type which is the object of our study.

In addition, all kind of exchange between companies involve transaction cost. Previous studies have done many studies on interfirm exchange. In this case crowdsourcing particular, we are talking about company in Japan, need to make good relationship with individual contractor in over see who never see and discuss any business. Therefore, transaction cost theory should major impact on quality control of

the crowdsourcing. So, we discuss transaction cost theory.

2.1 Product Architecture and Crowdsourcing

According to Ulrich (1995), “Product architecture is the scheme by which the function of a product is allocated to physical components. In informal terms, the architecture of the product is the scheme by which the function of the product is allocated to physical components.” From this, he defined product architecture more precisely as (1) the arrangement of functional elements, (2) the mapping from functional elements to physical components, (3) the specification of the interfaces among interacting physical components. In other words, “Architecture” means “how to divide a product into its components and processes, distribute product functions there, and the interfaces between the required parts and processes (“joints” to exchange information and energy how to adjust the part) is a design concept.” (Fujimoto, et al. 2001) We found that we could think of the idea of the product architecture that divides the product into components and processes and distributes the product functions to the items ordered by crowdsourcing.

According to Ulrich (1995), “The first distinction in the typology is between a modular architecture and an integral architecture. A modular architecture includes a one-to-one mapping from functional elements in the function structure to the physical components of the product, and specifies decoupled interfaces between components. An integral architecture includes a complex (non one-to-one) mapping from functional elements to

physical components and/or coupled interfaces between components.”

Fujimoto (1998) mentioned to product architecture, and also, he divides architecture into four typologies based on Ulrich (1995). It is said that there is a distinction between "modular type" and "integral type", "opened type" and "closed type" in the product architecture (Ulrich, 1995: Fine, 1998: Fujimoto, 1998: Baldwin and Clark, 2000). Based on this distinction, in summary, it can be categorized into four. (1) closed integral, (2) closed modular, (3) opened integral, (4) opened modular.

Figure 3: Four categories of architecture

	integral	modular
closed	Car Motorcycle Small appliances	Machine Tools Lego
opened		Computer Packaged software bicycle

Source: Fujimoto, et al. (2001)

Fujimoto, et al. (2001) described four types as follows. First, it is opened type. A

product of opened architecture is basically a modular product and also refers to a product that the interface standardized at the industry level beyond the company. Therefore, by gathering and linking good parts from different companies, products with high functionality are immediately produced without complicated "rubbing".

Next is closed type. Products in closed architecture refer to those in which the interface design rule between modules is basically closed within one company. Therefore, basic design such as product function and interface design is completed within one company. In other words, it basically refers to a system that manufactures products in-firm.

Third is modular type. The relation between function and parts (module) is close to 1 : 1, and it means that it has a simple form. Looking at each part, each individual part is given a very independent function. Therefore, exchange of signals and energy with other parts are not necessary. That is, the interface is relatively simple.

Last is integral type. Relations among parts are complicated. In other words, there is a many-to-many relation between functions and parts, not one to one. Therefore, designers of each module (component) need to make fine-tuning of the designs to each other, and to work closely with each other.

By applying these to crowdsourcing, it will be classified as opened and modular, from the description that it is the opened-type "basically a module product". In this case, crowdsourcing refers to micro-task type or competition type. Since the task itself is

simple, there is little interaction such as discussion between the orderer and the contractor. However, when we talk about project type, we can't consider this as opened and modular architecture. Because project type needs to maintain the close relationship between the orderer and the contractor. That is, project type includes task with a complicated interface structure, so we found that it will not be established without interaction between modules (parts / components). Also, it means the connection between the interfaces is very strong with regard to the project type. In other words, it means that there are many transaction costs generated in the interface part of the project type crowdsourcing.

2.2 Transaction Cost and Crowdsourcing

In the previous section, we discussed the importance of the connection of interfaces in the project type. And then explained that it costs transaction cost. So, now we talk about transaction cost to find out how transaction cost involved in quality control of project type in crowdsourcing.

According to Shimaguti, et al. (2013), "Transaction costs are the costs incurred in conducting economic activities." Specifically, it includes a search cost for finding a counterparty, information collection cost on products / services to be traded, a cost for negotiating based on the collected information, a cost for verifying the transaction result. Here, we applied the problem of quality control to transaction cost theory. For example, if orderer can't find the appropriate contractor, the desired product will not be completed.

Also, if orderers can't properly exchange information and negotiate with contractors, good products will not be completed. In this way, when the transaction cost is high and proper transactions are not made, the quality of the product decrease.

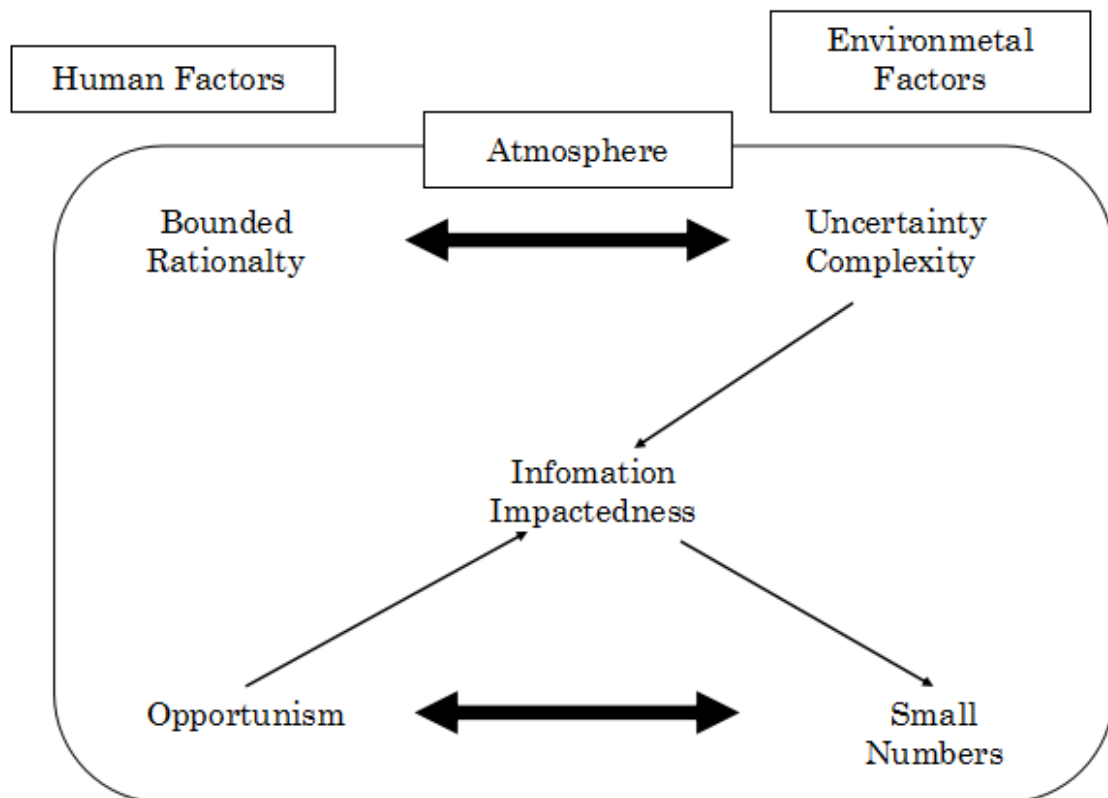
According to Williamson (1975), "The costs of writing and executing complex contracts across a market vary with the characteristics of the human decision makers who are involved with the transaction on the one hand, and the objective properties of the market on the other." That is, cost varies not only by environmental factors but also by human factors. In addition, "The human and environmental factors that impede exchanges between firms (across a market) manifest themselves somewhat differently within the firm, the same set of factors apply to both." (Williamson, 1975). In other words, because factors that interfere with the exchange are various factors that affect quality in the case of crowdsourcing. It seems that there is a relationship between the factor part and the cost part. In the first part, fluctuation in transaction costs are caused by environmental factors and human factors. In the second part, corporate transactions are hindered by a combination of two factors, environmental factors and human factors. Various factors affecting quality when factors that interfere with the exchange are applied to crowdsourcing.

Next, we will look closer in detail on these human factors and environmental factors. Williamson (1975) mentioned that the environmental factors are uncertainty and small numbers, the human factors are bounded rationality and opportunism, what is born from

these connections is information impactedness. Regarding these factors, Williamson (1973) said, “Whether markets experience contractual problems as a result of bounded rationality and opportunism turns on a related set of transactional factors. Thus, the consequences of bounded rationality are less severe if the transactions in question are uncomplicated and experience little uncertainty. Similarly, opportunism is restricted if competition reliably obtains or if information asymmetries can be overcome at little cost.” From this, it is considered that the major factor causing the transaction cost is bounded rationality and opportunism.

The relationship between the five factors are shown in the figure below.

Figure 4: The Organizational Failures Frame



Source: Williamson (1975)

Now, we explain each of the five factors. The first is bounded rationality. Bounded rationality refers to human behavior that is “intendedly rational, but only limitedly so” (Simon, 1961). The second is uncertainty. Uncertainty refers to a state that is uncertain in advance as to what will happen (March and Simon, 1958; Inoue, 1991). The third is opportunism. Opportunism extends the conventional assumption that economic agent is guided by considerations of self-interest to make allowance for strategic behavior (Williamson, 1975). The fourth is the small numbers. If a large number of traders are roughly equally qualified to supply the good or service in question-not merely at the outset but also (inasmuch as environmental uncertainty and bounded rationality render once-for-all contracts uneconomical) at contract renewal intervals competition will obtain, trading ranges will be narrowly restricted, and market exchange will be attractive. But while frequently a large numbers condition will seem to obtain at the outset, this may be illusory or may not continue into contract renewal stages. The illusion is that implicit homogeneity assumptions may not be satisfied (Williamson, 1975). Last is the information impactedness. Information impactedness is a derivative condition that arises mainly because of uncertainty and opportunism, though bounded rationality is involved as well. More than asymmetry is implied by our use of the term impactedness (Williamson, 1975).

We applied these factors to crowdsourcing respectively. First is bounded rationality. There are things that you want to do within yourself, but you can't do with your own abilities. Because, from the standpoint of orderer, when there is no skill to convey the content of the work, it can be considered as an example that the intention is not well transferred to the contractor. And from the standpoint of a contractor, when the contractor doesn't have the skill to communicate his or her own ability, it is impossible to receive an appropriate business order. Second is uncertainty. There are expenses for solutions to be taken to avoid risks such as discontinued communication with the contractor. Third is opportunism. There are such things as setting the amount of remuneration cheaply in order to gain their own profits, and falsely telling the contents of the first request. Forth is small numbers. The more proposals for the ordered product, the better the quality may be. Last is information impactedness. It is sometimes caused because it is difficult to convey all the business contents ordered by itself from factors such as company outline.

Project type crowdsourcing is complicated task by task, so it is very difficult for orderers to convey work contents of products they want to contractors. Also, it is difficult for a contractor to make an orderer's proposal accurately. Furthermore, since they do transactions of complicated tasks with partners who have never met or have exchanged, there is no trust or understanding of the partner.

Essentially, project type crowdsourcing can be exchanged only on the Internet

communication, but because it is a deal with people who have never exchanged, transaction cost is very high. It also explained that the quality decrease due to high transaction costs. Therefore, it is important to present a solution to decrease transaction costs.

In other words, to solve this problem, it is very important to explain the interface part with transaction cost theory. After thinking about the relationship between crowdsourcing and transaction cost theory, we conducted a company interview to fit theory and practice based on that knowledge.

3. HYPOTHESIS FORMATION

In the previous section, we showed that the concept of transaction cost theory and product architecture are important to explain the problem of crowdsourcing in previous study. However, there were no previous studies that clarified the problems for people actually using crowdsourcing. Therefore, we interviewed people who actually use crowdsourcing, to ask the problem of crowdsourcing. In addition, discuss whether transaction cost theory or product architecture are involved in the problem. Based on discussion of fieldwork, we constructed a concrete hypothesis.

3.1 Explorative Field Work in Real crowdsourcing businesses

We interviewed the three positions of platform, orderer, and contractor from July 12th

(2017). eleven platforms, eleven orderers (person who is making oversea order: four people), eight contractors. First of all, we interviewed a platform that provides opportunities for matching contractors and orderers. As the platform selection criteria, first the population is set to 28 regular members of the crowdsourcing association and 48 companies registered in the Crowdsourcing JAPAN site. Among them, sixteen companies dealing with project type subject to the study were appointed, and interviewed eleven companies. Our study adopted a semi-structured interview. As a reason that we chose it is the most effective method to understand retrospective and ongoing information. After we transcribed every recorded conversation data and analyze these data.

Next, we interviewed eleven orderers. Selection criteria are as follows.

1. Being an orderer who has registered with Lancers or Crowd Works of two major companies of the platform of crowdsourcing.
2. Doing project type crowdsourcing.
3. Be a randomly selected orderer.

Selection was also made following this standard. Also, to confirm whether there is a difference between ordering overseas and ordering to Japan, four orderers have orders overseas among eleven orderers.

Selection criteria for eight contractors are the same as those for the orderer.

1. Being a contractor who has registered with Lancers or Crowd Works of two major companies of the platform of crowdsourcing.
2. Doing project type crowdsourcing.
3. Be a randomly selected contractor.

We finished those interviews when the result was converged. Interview analysis method is the same as for platform. We organized the content of the interview that referring to qualitative data analysis method (Sato, 2008). Based on the data recorded in interview, we focused on the actual situation and words and identified problems and solutions for crowdsourcing. Next, we identified and named factors according to similar condition and effects from collected data. Based on the interview, we have derived the location and factors of the new problem of quality control which is the problem of crowdsourcing.

Firstly, in the previous study, it was said that there was a problem with the quality of the contractor. However, based on the interview results, it was found that there was a problem in the orderer. There were eight platforms out of eleven, six out of eight contractors, and ten out of eleven orderers themselves had problems with the orderer. Specific responses of the orderer are listed below.

Orderer A said “Since the existence of individual recognition is difficult before, the requirement definition of the orderer is important. However, I think that there are many

people who can't do it.”

Orderer B said “When there have been many suggestions, it is difficult to pick a good proposal.”

Orderer C said “Knowledge about the work to be ordered is almost eliminated. And it is difficult to properly communicate with the contractor.”

The results of these interviews are clearly stated in the attachment. Based on the results of these interviews, it was cited as a factor that the orderer properly informs the business content and selects the contractor. We set factors called Ordering Skill based on the five codes (ordering skill, reward setting, direction skill, requirement definition, submission deadline of product) in analyzing the factors that the orderer has problems. And, also we set called Selection Skill based on the five codes (contact details, portfolio, evaluation, proposal contents, profile) in analyzing the factors that the orderer has problems.

1. Ordering Skill is the ability to convey work contents and contract details appropriately and easily to contractor.
2. Selection Skill is a skill that allows an orderer to select a contractor suitable for the company from information on the platform.

We find that these two factors serve as major barriers and transaction costs will increase. Then it will affect quality of products. In the previous study, it was said that

there was a problem with the contractor, but in this study, we found through the interview that there is a problem with the orderer. And we also found that transaction cost theory is important in transactions between companies. In the interviews 24 companies out of 30 companies set that there is a problem with the orderer.

3.2 Hypothesis Development

Here, we explain two hypotheses from factors and one hypothesis from relationship between quality and transaction cost theory.

Based on the interview results, six of the eleven orderers were said to be the most important skills of the orderer is communication with the contractor. Even how each word is caught may have different recognition. So, when conducting an order, it is necessary to finely define the work content, the submission date of the product, the amount of remuneration, and to dedicate communication closely. Specifically, the image of the work presented by the orderer is different, and the requested product can't be completed. However, Ordering Skill can decrease the complexity of parts of the interface and lead to lowering transaction cost. Therefore, when the orderer has the skill of these Ordering Skill, the transaction cost lowers. From here, we constructed H1a.

H1a: When the higher ordering skill firm has, the lower the transaction cost in crowdsourcing will be.

The tendency of companies with less struggling to select contractor is less experienced

in quality troubles was derived from seven interview results and cases out of eleven. Specifically, companies said that they were worried about choosing the contractor with what index. For example, which information on the platform (the number of orders experience, profile, etc.) should be used to select the contractor.

If orderer can select favorable recipients for the business requested by them, it is possible for the orderer not to be informed of the business even if they are not in close contact with the requested case, so that the interface. You can reduce the complexity of the transaction and lower transaction cost. Therefore, when the orderer has the skill of these selecting the contractor, the transaction cost lowers. From here, we constructed H1b.

H1b: When the higher Selection Skill firm has, the lower the transaction cost in crowdsourcing will be.

In crowdsourcing, transaction cost is a big barrier when doing business with unknown crowds. In other words, the higher the skill of hypothesis H1a and H1b, the lower the transaction cost. We find that it will affect quality of the products.

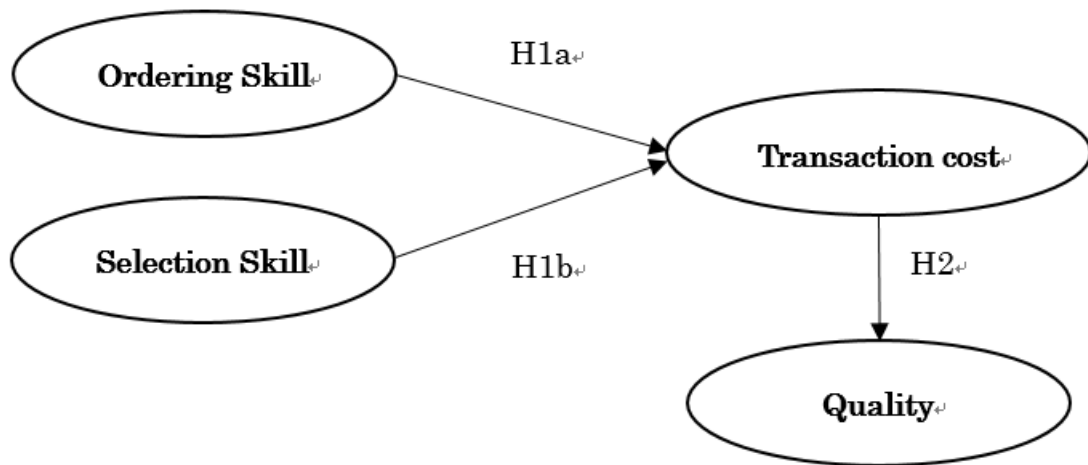
If transaction cost is high, transaction cost is high and quality of product is reduced if appropriate contractors are not found or negotiations with contractors are not possible. However, if the orderer can lower the transaction cost, this can also simplify the interface. Then the deal drops, the quality of the product increases. From here, we constructed H2.

H2: When quality increase, transaction costs decrease.

It is found that the ability of each orderer's instruction and selection of the contractor will lower the transaction cost and improve the quality of products. In other words, it is thought that each ability doesn't directly affect the quality, but the volume of the transaction cost influences the quality of the products. Therefore, if the above ability is high, it is thought that the transaction cost is decreased, and as a result the quality of the product is increased. Also, we find that companies can't fully understand the importance of these skills. Because seven out of eleven orderers said that when doing crowdsourcing, it is commonplace that there are times when it is not convincing, such as quality, because it is communication on the Internet. They think that there are some resistance to the transaction on the Internet. Other, even though individuals know these skills are important, some companies don't take measures in the organization of companies. In other words, the priority for companies to raise these skills is low. Companies don't think that these skills are so important.

Thereby, this study insists on the importance of these skills and the impact on quality. The relationship between two factors, Ordering Skill and Selection Skill, transaction cost, Quality is described in Figure 5.

Figure 5: Conceptual model



Source: Author

4. METHODOLOGY

In this section, we conducted a questionnaire to the orderer. This was done for the purpose of obtaining quantitative data for hypothesis verification.

4.1 Procedure and Sampling

We sent questionnaires using e-mail, SNS (Twitter, Facebook) to the questionnaire subject using the online web questionnaire tool (Google Form). Samples were targeted at Japanese who fulfilled the following two criterias.

The two criterias are:

- (1) Being a orderer of a crowdsourcing.
- (2) Experience of ordering of project type business of crowdsourcing.

The reason for this is that it is necessary to clarify the direction and strength of causality in the relationship between the two abilities of the orderer who places the project type business, the transaction cost, and the causal relation between the transaction cost and the quality control. In addition to because it is the orderer to evaluate the quality of deliverables in crowdsourcing.

The reason for using the subject of this questionnaire as an orderer is that receives products that can refer to the quality of products. We distributed e-mails and SNS to questionnaires between October 10, 2017 and October 31, 2017. Several targets refused our offer. As a result, 152 answers were collected.

Our hypotheses and questionnaire are based on a combination of semi-structured interviews and from our literature review. A total of seventeen items are set. The items of Ordering Skill, Selection Skill, are scored on the Ricard scale ranging from 1 (thinking very low) to 5 (thinking very high). In addition, the item of transaction cost scores on the Ricard scale ranging from 1 (almost nothing) to 5 (very much). However, the item on limited rationality shall be scored as 1 (very likely) to 5 (almost none). Items of Quality 1 are scored on a Ricardian scale ranging from (almost not obtained) to 5 (very obtained).

4.2 Data analysis and Result

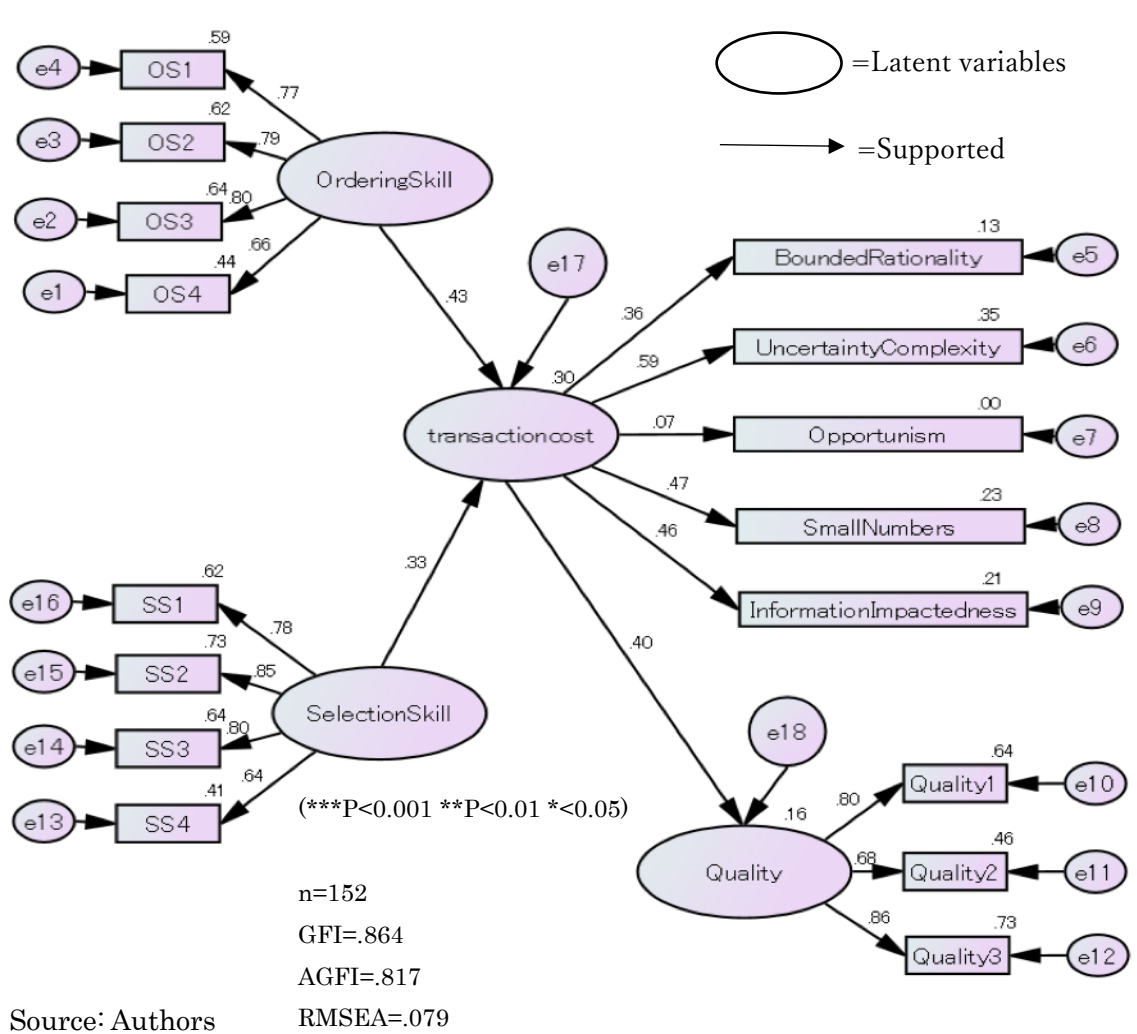
In this study, we will examine using SEM (structural equation modeling). SEM is a statistical method widely used in fields such as behavioral science for the purpose of investigating causality (Hox and Bechger, 2007). We quantitatively analyzed causality

that two independent variables affect dependent variables. To analyze the hypotheses described above, Amos' SEM was used in this analysis, which analyzed the causal relationship between independent and dependent variables.

First, we explain the result of R-squared representing the degree of fit of the regression equation estimated for the data for this analysis. The R-squared of transaction cost recorded 0.30. And The R-squared of Quality recorded 0.16. Next, we explain the result of the path coefficient representing causality and correlation for this analysis. From a standardization perspective, the path coefficient between Ordering Skill and transaction cost recorded 0.43. And the path coefficient between Selection Skill and transaction cost recorded 0.33. So, H1a and H1b were adopted. Also, from a standardization perspective, the path coefficient between transaction cost and Quality recorded 0.40. So, H2 was adopted.

In addition, we explain the result of P-Value indicating the significance probability in this analysis. P-Value of transaction Cost recorded 0.084. And Ordering Skill, Selection Skill and Quality recorded ***. (***) $P < 0.001$ ** $P < 0.01$ * $P < 0.05$) Finally, the fitting of the model was seen. GFI was 0.864, AGFI was 0.817 and RMSEA was 0.079.

Figure 6: Result



5. Discussion

In this section, we discuss based on analysis results. We discuss based on the result of Covariance Structure Analysis using the questionnaire result as a variable.

First, it was found that the adoption of hypotheses 1a and 1b affects the transaction cost by Ordering Skills and Selection Skills.

In the previous study, Kashima, Kajino (2012) mentioned to that orderer was

concerned about the ability of the contractor. So, there is a problem with the contractor. However, this was not necessarily correct. In this study, it was found that the skill of the orderer, for instance, orderer carry out to make it easy to understand the detail of work greatly affects transaction cost. We were able to show that Ordering Skill and Selection Skill are very important.

Next, by adopting H2, it found that the transaction cost has an influence on quality. In previous studies, there has been no numerically clear study showing the relationship between the crowdsourcing and transaction cost, transaction cost and quality related. Thus, in this study it was possible to clarify that transaction costs are related to the quality of crowdsourcing. In other words, here, it is possible to explain the factors that can affect the quality by transaction cost. That is an Ordering Skill and a Selection Skill. Williamson (1975) mentioned to that cost varies not only by environmental factors but also by human factors. According to the analysis result, it was found that this human factor is Ordering Skill or Selection Skill in crowdsourcing. To summarize, as the three hypotheses were adopted, we found that the skill of the orderer such as Ordering Skill and Selection Skill did not directly affect the quality of the product but acted on the transaction cost, and it affects the quality of the product. In other words, to decrease the transaction cost is a factor that affects increasing the quality of the product. According to Baba and Kashima (2013) "One of the important tasks in crowdsourcing is quality control of products created by contractors." However, in this study, it was found that Ordering skill and Selection skill affect transaction cost, and transaction affects the

quality. For that reason, it is necessary to enhance the skill of the orderer to improve product quality.

In architecture, project type crowdsourcing was said to apply to opened integral. The reason for this is that the project type is complicated, so transaction costs are considerably applied to the interface part. In that regard, in the interview with the orderers, six companies out of the eleven companies of Ordering Skill, ten out of eleven companies of Selection Skill thought that it was important.

Looking at the answer to the interview, the eleven orderers who interviewed this time recognized the importance and there were orderers that were making efforts to raise their skills. But some orderers were not doing it.

Regarding Ordering Skill, some orderers made measures to create a format of work content so that there is no omission of contents of the request, and create a contract to clarify the delivery date and fee between the orderer and the contractor it was. Regarding Selection Skill, some orderers did carefully confirm the results of past business and do interview beforehand via videophone. In this study, we were able to show the importance of enhancing skills. Therefore, orderers that are not making efforts to raise their skills are worth doing these efforts.

However, many companies were not satisfied with the quality even though these efforts were made. In other words, although some solutions are taken, there are not many companies that are getting effective. This indicates that the priority order of the

Ordering Skill and Selection Skill solutions are low for the company. Therefore, it does not organize long-term solution as an organization, and it becomes a solution which the individual thinks are ineffective.

Finally, we consider the numerical value of the analysis result. In the analysis result, only the item of the opportunism which is one factor of the transaction cost recorded a numerical value as low as 0.07. Nawa (2009) mentioned that Japanese people and Japanese companies emphasize the relationship of trust and loyalty. This has resulted in a low result of 0.07. In addition, trust has the function of suppressing opportunistic behavior, which tends to occur during market-based transactions (Chinen, 1997). So, in this study that targeted Japanese as a questionnaire, the opportunistic behavior of Japanese companies, and Japanese companies influenced the questionnaire results, and it is interpreted that these low figures were recorded. As mentioned above, since the numerical value of the item of opportunism is low, the P-Value of the transaction cost was 0.084.

6. Implication and Future direction

The objective of this study is to solve the quality control of crowdsourcing. As a result of the previous research review, we focused on project types that didn't show any solution for quality control problems. And transaction cost theory was found to be very important when explaining project type problem.

We interviewed companies (platform, orderer, contractor) who uses crowdsourcing based on the contents of the previous study. As a result, we found that the problem of quality control is caused by the orderer and whether it is important to raise the Ordering Skill and Selection Skill. Therefore, in order to clarify the relationship between Ordering Skill and Selection Skill, transaction cost, quality of products, we conducted a questionnaire for the orderer. This questionnaire numerically clarifies the relationship of three things (Ordering Skill and Selection Skill, transaction cost, quality) which were not shown in the previous research and finally presented the importance of Ordering Skills and Selection Skills.

This study contributed in two ways: theoretical and practical contribution. Regarding the theoretical aspect, we have clarified the problem of quality control by using product architecture and transaction cost theory. Regarding product architecture, we found that the interface cost is high for the project type crowdsourcing. Regarding transaction cost theory, we clarified that the ability of the orderer influences the increase and decrease of the transaction. And furthermore, it affects the quality.

Regarding the practical aspect, we clarified two things: the first is that the place of the problem is located in the orderer. In the previous study, the location of the problem was said to be the quality of the contractor. However, it is not so, that the orderer has big cause. The second, is to improve Ordering Skill and Selection Skill leads to improvement of quality. Through an interview for the orderer, we found importance of

enhancing these skills.

In this paper, there are three limitations of study and future subjects. First, it was not possible to clearly set the sample size, and it was impossible to narrow down the target person who answered the questionnaire. Therefore, the number of sample size who responded to the questionnaire was 152. And it became a small number. As a cause, it seems that there are also reasons for the fact that there were many people who only registered accounts on the platform of crowdsourcing or people who used less experience when selecting questionnaire respondents and extracted.

Next, the questionnaire respondent was the orderer only, and the item concerning skills at the time of ordering itself became self-evaluation. However, this is considered to be the best method because it is the orderer that it is possible to judge the quality of products. In the future, methods should be suggested companies concretely.

Finally, as future study subjects, to improve these skills and to suggest specifically methods. Some orderers have made an effort by recognizing the importance of ordering skills.

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Accompanying material. Detail of first interview with companies-1

Number (category)	DATE	Place(method)	Problem of crowdsourcing(Where is the problem of crowdsourcing)
NO. 1(Orderer)	8/9(2017)	cafe shop(Roppongi)	There is a problem of quality control. I also think there is a problem of communication.
NO. 2(Orderer)	8/9(2017)	the office of the other party(Higashimurayama)	It is difficult to set the amount of remuneration.
NO. 3(Orderer)	8/15(2017)	café shop(Shibuya)	There is a problem with the ordering side. It is difficult to set the amount of remuneration.
NO. 4(Orderer)	8/15(2017)	the office of the other party(Iidabashi)	I think there is a problem with explaining business.
NO. 5(Orderer)	8/7(2017)	cafe shop(Daikanyama)	There is a problem with the direction of business.
NO. 6(Orderer)	8/2(2017)	the office of the other party(Shibuya)	It is difficult to select a proposal from the contractor.
NO. 7(Orderer)	8/9(2017)	the office of the other party(Shibuya)	It is difficult to select a competent contractor.

Accompanying material. Detail of first interview with companies-2

NO. 8 (Orderer)	8/8 (2017)	the office of the other party (Shibuya)	It is difficult to properly communicate the work content.
NO. 9 (Orderer)	8/21 (2017)	cafe shop (Shinagawa)	It is difficult to communicate the work content to the other party. Communication is important.
NO. 10 (Orderer)	8/23 (2017)	the office of the other party (Omotesando)	It is difficult to clarify the work content.
NO. 11 (Orderer)	8/24 (2017)	hospital (Ageo)	It is difficult to search for an orderer suitable for the task to be requested.
NO. 12 (Platform)	7/13 (2017)	the office of the other party (Shinjyuku)	There is a problem with ordering skills.
NO. 13 (Platform)	7/13 (2017)	telephone	There is a problem in terms of quality control. Worker quality is low.
NO. 14 (Platform)	7/26 (2017)	the office of the other party (Tokyo)	There is a problem with the requirement definition of the ordering side.

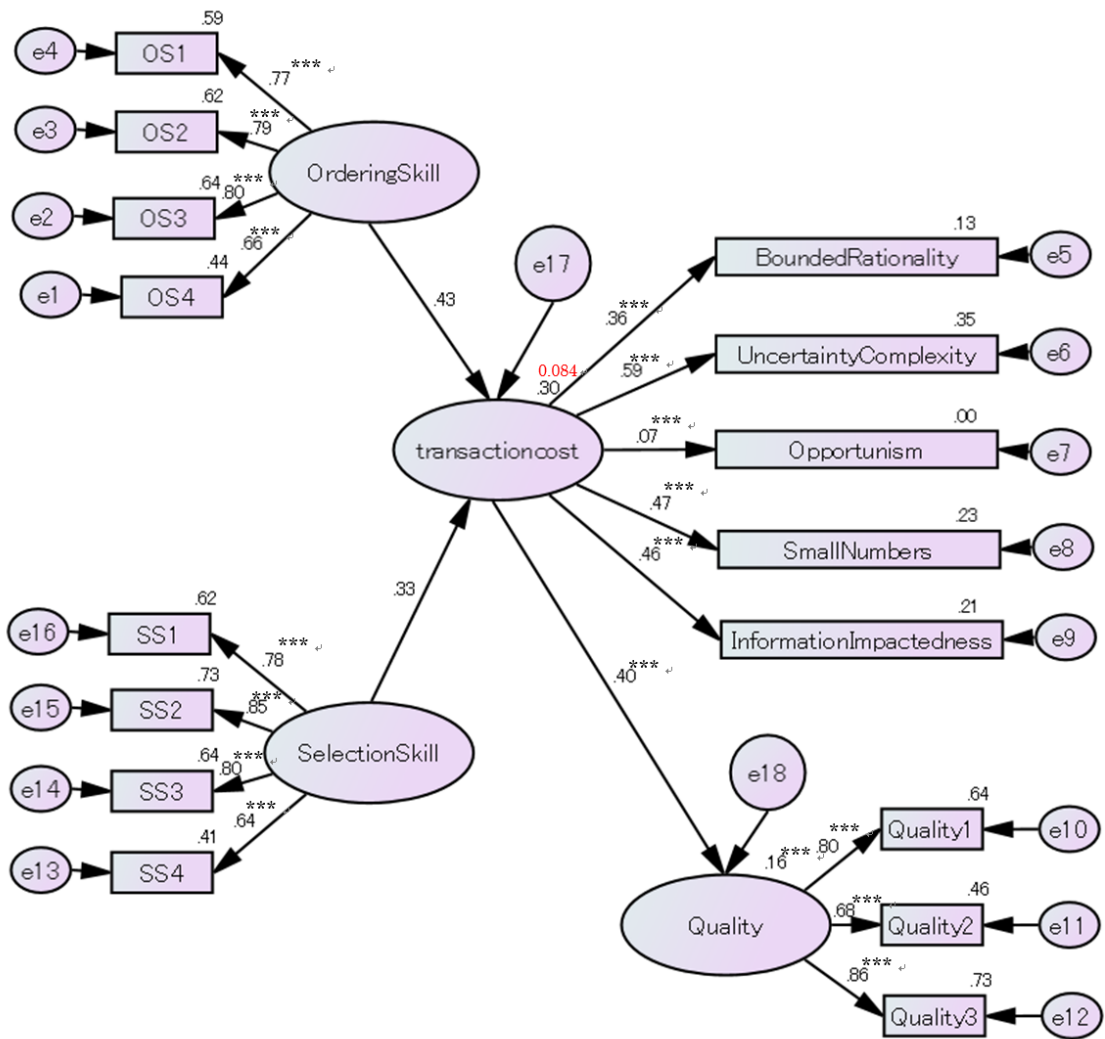
Accompanying material. Detail of first interview with companies-3

NO. 15(Platform)	8/3(2017)	the office of the other party(Harumi)	There is a problem with the ability of the ordering side.
NO. 16(Platform)	7/13(2017)	cafe shop(Shibuya)	The amount of compensation for the orderer may be set too low.
NO. 17(Platform)	7/24(2017)	the office of the other party(Shinjyuku)	There is a problem with the ability of the ordering side and communication.
NO. 18(Platform)	7/25(2017)	the office of the other party(Shinjyuku)	There is a problem with communicating.
NO. 19(Platform)	7/26(2017)	the office of the other party(Koujimachi)	There is a problem of having to put a lot of effort on contact.
NO. 20(Platform)	7/26(2017)	the office of the other party(Shibuya)	There is a problem with the low price of remuneration.
NO. 21(Platform)	8/8(2017)	the office of the other party(Ebisu)	There is a problem in terms of quality control.
NO. 22(Platform)	8/9(2017)	the office of the other party(SHIBUYA)	There is a problem in setting the amount of compensation.
NO. 23(Worker)	8/15(2017)	cafe shop(Shibuya)	There is a problem with the ability of the ordering side, especially the

Accompanying material. Detail of first interview with companies-4

NO. 23 (Worker)	8/15 (2017)	cafe shop (Shibuya)	There is a problem with the ability of the ordering side, especially the requirement definition.
NO. 24 (Worker)	8/18 (2017)	cafe shop (Shibuya)	Explanation of the ordering side is sometimes complicated.
NO. 25 (Worker)	8/17 (2017)	cafe shop (Shibuya)	It is difficult to deal with due to the wide range of crowdsourcing operations.
NO. 26 (Worker)	8/9 (2017)	cafe shop (kasai)	There is a problem in terms of quality control.
NO. 27 (Worker)	8/9 (2017)	the office of the other party (Shinjyuku)	There is a problem of having to put a lot of effort on contact.
NO. 28 (Worker)	8/23 (2017)	the office of the other party (Harajyuku)	It is necessary to make efforts to contact.
NO. 29 (Worker)	8/21 (2017)	cafe shop (Shibuya)	The problem is the lack of ability to place orders.
NO. 30 (Worker)	8/24 (2017)	hospital (Ageo)	There is a problem with not being able to define requirements.

Analysis result



標準化係数：(グループ番号 1 - モデル番号 1)

		推定値
TC	<--- OS	.430
TC	<--- SS	.334
Quality	<--- TC	.404
OS4	<--- OS	.664
OS3	<--- OS	.798
OS2	<--- OS	.789
OS1	<--- OS	.770
BoundedRationality	<--- TC	.356
UncertaintyComplexity	<--- TC	.588
Opportunism	<--- TC	.065
SmallNumbers	<--- TC	.475
InformationImpactedness	<--- TC	.463
Quality1	<--- Quality	.798
Quality2	<--- Quality	.680
Quality3	<--- Quality	.857
SS4	<--- SS	.642
SS3	<--- SS	.798
SS2	<--- SS	.854
SS1	<---SS	.785

重相関係数の平方

	推定値
TC	.297
Quality	.163
SS1	.616
SS2	.729
SS3	.637
SS4	.412
Quality3	.735
Quality2	.463
Quality1	.636
InformationImpactedness	.214
SmallNumbers	.226
Opportunism	.004
UncertaintyComplexity	.346
BoundedRationality	.127
OS1	.593
OS2	.623
OS3	.637
OS4	.441

分散：(グループ番号 1 - モデル番号 1)

	推定値	標準誤差	検定統計量	確率	ラベル
OS	.291	.068	4.289	***	
SS	.299	.072	4.158	***	
e17	.177	.103	1.727	.084	
e18	.494	.100	4.918	***	
e1	.369	.049	7.470	***	
e2	.292	.049	5.899	***	
e3	.317	.052	6.069	***	
e4	.372	.058	6.384	***	
e5	1.736	.218	7.956	***	
e6	.958	.161	5.970	***	
e7	1.941	.224	8.668	***	
e8	.807	.112	7.200	***	
e9	.662	.091	7.299	***	
e10	.338	.065	5.209	***	
e11	.584	.081	7.194	***	
e12	.254	.068	3.733	***	
e13	.427	.055	7.773	***	
e14	.256	.041	6.275	***	
e15	.183	.036	5.029	***	
e16	.283	.044	6.504	***	

Crowdsourcingの業務の発注に関するアンケート

日本大学法学部白井ゼミナールのトピトとお進です。
私どもはクラウドソーシングに関する研究を行なっています。
現在研究の一環としてアンケートを行なっております。
クラウドソーシングで業務の発注を行なっている方（国内または海外へのいずれかの発注経験のある方）を対象としたアンケートです。
1から11まですべての回答をよろしくお願い致します。

***必須**

1. クラウドソーシングで外国籍の方に発注した経験はありますか？*

当てはまるものをすべて選択してください。

- はい
 いいえ

海外への発注の経験のある方はその時のことについてご回答ください。
海外への発注の経験のない方は国内へ発注した際のことについてご回答ください。

あなたがこれまでクラウドソーシングで発注した業務の成果物の品質
に関してお聞きします。

2. あなたが提示する金額に見合った品質を得られていますか？*

当てはまるものをすべて選択してください。

- とても得られている
 やや得られている
 どちらでもない
 あまり得られていない
 ほとんど得られていない

3. あなたが提示する納期に対して見合った品質を得られていますか？*

当てはまるものをすべて選択してください。

3. あなたが提示する納期に対して見合った品質を得られていますか？*

当てはまるものをすべて選択してください。

- とても得られている
 やや得られている
 どちらでもない
 あまり得られていない
 ほとんど得られていない

4. あなたが提示する業務内容に見合った品質を得られていますか？*

当てはまるものをすべて選択してください。

- とても得られている
 やや得られている
 どちらでもない
 あまり得られていない
 ほとんど得られていない

あなたの業務発注におけるスキルを自己評価してください。

5. 5.*

当てはまるものをすべて選択してください。

	とても高いと 思う	やや高いと 思う	どちらでも ない	やや低いと 思う	とても低いと 思う
報酬額を適切に設定する スキル	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
納期を適切に設定する スキル	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
依頼業務内容を適切に設 定するスキル	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
受注者と依頼内容に対し て適切なやりとりを行う スキル	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

あなたの受注者選定におけるスキルを自己評価してください。