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The role of network boundary information
in intellectual capital measures

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Abstract

In this paper, we will explore the role of network information in intellectual capital measures, focusing specifically on data from lender-borrower relationships. Our analysis found as follows: First, Japanese lenders who judge the creditworthiness of firms, place a great deal of importance on network boundary information in comparison to human resources and technology. Second, while Japanese lenders confront difficulties in accessing and evaluating a firm's human resources and technology, they comprehend that both resources are essential performance generators for firms. Third, lender perceptions show that both human resources and technologies are highly correlated to the larger network information. How do we interpret these local practices to help explain the surrounding societal context? This paper provides three possible interpretations as follows: First, Western philosophical and scientific perspective leads us to postulate that lenders are efficient, rational decision makers. Second, the New Institutionalism concludes that lenders make decisions in accordance with social norm determinants, rather than for personal optimization. Third, a pragmatic interpretation of the phenomenal use of network information from the more traditional philosophical awareness and rejection of the perfect measurement idea can be as follows: Lenders make decisions based on their daily practice and reflection on firms' human resources and technology within the socially shared context.

Key words

Intellectual capital, Network, Lender-borrower relationship, New institutional theory, Micro-macro synthesis

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1. Purpose

Before the 1980's, the Japanese lender-borrower relationship lending was characterized by longevity. This would change after the middle of the 1980's when Japan would enter into a bubble economy or boom economy. While lenders depended on the economic value of land holdings and real estate to determine trustworthiness when lending money to borrowers, this philosophy will be a myth as land and real estate values keep appreciating. The bubble economy turned in a similar fashion as the U.S. real estate collapse. After this Japanese financial, land value, and real estate crash in the early 1990's, Japan was forced to shift toward another style of securing lending relationships and building trustworthiness. This new method relies more on "hard," or financial, information and lending is now based on finance theory consistent with the Western philo-scientific perspective. The shift led to two market reactions: 1) high competition between lenders, and 2) low profitability. The lenders' heavy reliance on financial figures limited the advantages between lenders, and high competition meant that not all firms would be able to survive. In efforts to counteract this market reaction, the Japanese Financial Service Agency (FSA) introduced an action program that was intended to help all lenders survive the harsh market conditions. The "Program for strengthening Relationship Banking Function," introduced in March 2003, enhanced the lender's ability to judge a borrower's trustworthiness using "soft," or intellectual capital (IC), information (Yosano and Nakaoka, 2011a). While the FSA works to strengthen lending relationships, the Ministry of Economy, Trade, and Industry (METI), on the other hand, focuses on IC information. In Japan, the METI strives to strengthen information transference between firms and stakeholders.

IC information includes the corporate strategy, technology, intellectual property, human resources, and networks. All of these factors are seen as promising engines for lenders, and the efforts of the METI to promote the utilization and transference of these factors is actually supportive of the FSA's relationship lending action program (c.f. Yosano and Nakaoka, 2011a). Hard information generally involves a corporate financial track record and historically accumulated resources. However, the company is alive and

under constant change, therefore, the company should act on real social circumstances according to their corporate strategy. Intellectual capital is able to transform the actual corporate figures into a realistic picture of the borrower's trustworthiness. However, we cannot access IC information directly, because they are naturally, by definition, intangible. However, if lenders want to judge a corporation's true trustworthiness, then they should manage to find a way to evaluate the realistic picture. METI's initiative³ can motivate us to find the way to judge the actual corporate trustworthiness using IC information as studied in this paper.

We are motivated to see the realistic image of the corporation's business by studying their intellectual capital. With thanks to the METI initiative, we were able to access survey questionnaire data, and analyze how lenders use IC information to create trustworthiness with the borrower. We can hypothesize that lenders rely on network information to create trustworthiness. Our goal is to clarify how IC information is used by lenders judging a borrower's trustworthiness, and provide evidence that supports our hypothetical issue: "How network information helps to create trustworthiness with lenders?"

In this paper, we address the importance transferring IC information, especially within networks, to mitigate the information asymmetries between the firms and the lenders. We interpret the actual lenders judging practices by analyzing survey research that was conducted by METI in the 2008 fiscal year.

³The METI encouraged small businesses to disclose supplemental, non-financial information that could be used to determine the potential for growth and/or sustainability, and to eliminate information barriers for raising funds (Holland and Johanson, 2003). Following this example, the "Organization for Small and Medium Enterprises and Regional Innovation, Japan" (SMRJ), who is an affiliated association of METI, issued The Manual for SME Intellectual Capital Reporting in March 2007. This manual focuses on the specific concerns of small businesses. Non-financial information could further help convince lenders of the small businesses' trustworthiness when they provided IC Reports. This trend is a complete contrast from the "Guideline for disclosing Intellectual Assets Based Management" (GIABM) that focuses on big businesses as illustrated in detail by Sumita (2008) and Johanson et al. (2009). In fact, the number of small business disclosures has increased from thirteen in the 2006 fiscal year to sixty in the 2008 fiscal year. While sixty is a small number, it still reflects a dramatic increase over a two year period.

2. The lender's perception of IC information

In order for lenders to survive the inter-competitive market crippled from the severe economic recession of the late 1990s in Japan, lenders have been given a strong incentive to use “hard,” or financial, based lending technologies. However, “hard” information that is based on lending technologies drive lender to face low profitability, because of the difficulties with differential lending technologies. “Hard” information gives lenders equal opportunity to borrower information and increases the market competition. In this setting, the FSA introduced the action program in 2003. The action program encourages lenders to use “soft,” or IC, information based lending technologies (the FSA refers to this as “relationship banking”). Meanwhile, the METI initiative has supported this action program. The METI introduced in rapid succession both the “Intellectual Property Outline” in 2002 that focuses on the corporate technology and intellectual property (e.g. Johanson et al., 2006), and the “Guideline for disclosing Intellectual Assets Based Management” (GIABM) in 2005 which focuses on the broader corporate IC (e.g. Sumita, 2008; Johanson et al., 2009). Lending technologies expanded from “hard” information based traditional lending technologies, which were primarily underwritten based on strong financial ratios, to “soft” information based lending technologies that involve screening and underwriting policies/procedures, contract structuring, and monitoring strategies/mechanisms with IC information (Uchida et al., 2008). In this setting, we can review the literature with regard to lending technologies, and trace how the current practice with lending technologies has prevailed and the key role of IC information has played in reducing information asymmetries between firms and lenders (e.g. Holland and Johanson, 2003). This is especially true for small and medium-sized businesses (SMEs), because SMEs tend to face more difficulties when obtaining a working amount of capital and investment capital due to the credibility of their financial information. In other words, their financial

information has been regarded as “opaque.”

The challenge of establishing efficient lending technologies for SME's is becoming increasingly not only a practical issue, but also a matter of finding a relevant paradigm that is able to theoretically explain the needs for such technologies. It is also an issue to reconcile the contradictory findings on how credit decisions are achieved in the multifaceted lending industry. In the aftermath of bank crises and global recessions, the efficiency of lending technologies is becoming crucial, especially in relation to SME's which are often seen as promising engines for growth. However, lending to SME's is typically associated with high levels of uncertainty and scarce track records of success (Berger and Udell, 2006). Conventional thought holds that small, niche lenders have an advantage in relation to big banks through their greater capacity to process “soft” information, and are more able to deliver relationship lending (Uchida et al., 2007). However, big lenders are increasingly showing interest toward SMEs, and continuing to develop tools and services beyond relationship lending (Torre et al., 2010).

While the debate within economics has framed the problem as a large vs. small lenders problem, later findings suggest a more nuanced picture. Berger et al. (2005) found that large lenders who lend over a greater distance interact more impersonally with their borrowers, and have greater difficulties in collecting and making use of “soft” information. Hence, they are less willing to lend to informationally “difficult” credits. Instead, they tend to lend primarily to larger firms with consistent accounting records. However, Berger et al. (2005) points to the possibility that this tendency does not necessarily have to do with the bank size, but, rather, with finding an appropriate level of decentralization. They argued that the long-standing debate within economics about the boundary of the firm should be complemented with issues about the shortcomings of large organizations that create a greater distance between the information gathering and the decision-making authority of bank clerks.

As an extension of this former research, we may focus on what actually gets organized within larger lenders, such as the information and judgments with SME's. Berger et al.

(2005) argued that more attention should be directed toward issues with the nature of the firm and its business rather than on the formalization of information. According to this view, the solution for large lenders may lie in the possibility of decentralizing their operations to facilitate efficient processing of “soft” information and increase relationship lending. Berger and Udell (2004) suggested that “soft” vs. “hard,” in addition to “small” vs. “large” distinctions, should be nuanced by extending the present paradigm with analyses of various combinations of small and large banks and firms and a broader and more specified range of lending technologies. With this extension, they were able to find results that go with the grain with the dominant paradigm, such as suggestions that relationship lending is indeed a strength of small banks, but especially in relation to large firms. They also remarked that some lending technologies, such as the soft information technology used in judgment lending, are largely ignored by the present dominating paradigm.

Additionally, the Japanese economy is facing similar challenges. Discussing the challenges of Japanese regional banks, Choe (2007) called for the need to improve the lending technology by reducing screening costs and political pressure to achieve a more efficient allocation of financial resources and avoid suboptimal investment projects with regional SMEs or supporting non-performing SMEs alive. Uchida et al. (2008) also confirm in the Japanese context that the advantage small lenders have in relationship lending to SMEs matters, but that large lenders are increasingly lending to SMEs. Over the last decade, the METI has also taken a number of initiatives to improve the market communication through the use of IC reports, first for big firms, but more recently also for SMEs. The outcome of these initiatives has been controversial, indicating some interest but also to some extent skepticism against attempts to create “hard” measurements for “soft” issues.

In the intersection between accounting and finance theory, the character of the market and its ways of organizing exchange, addresses long-standing issues with the borders of the organization and whether a market may be characterized by network relations rather than fierce and anonymous competition. For example, the term relationship lending may indicate the point of the Uppsala school that many market relations stabilize into

repetitive interaction, forming patterns of interaction resembling an organization more than a market. In a similar perspective, SME's, while not formally integrated into bigger organizations, are typically part of a bigger context of other relations with customers, suppliers, service firms and other complementaries. Given these complexities beyond simple contingency-theory approaches, we may ask how credit-decisions are made "in the wild" (c.f. cognition in the wild) given all the contextual influences of concrete situations. Therefore, lending technologies may include more than the "soft" and "hard" distinction, and embrace more techniques to reduce complexity rather than quantifying information about SME's. Furthermore, the same figures may be used differently in different situations and by different actors.

In section 3, we analyze how lenders use IC information to create trustworthiness with the borrower. Through empirical evidence we will support our hypothesis that lenders rely on network information in order to determine a businesses trustworthiness. We adopted the factor analysis in order to visualize the latent IC measures such as the corporate strategy, technology, intellectual property, human resources, and networks. We hope to show how lenders try to interpret corporate figures into a realistic picture of the borrower's trustworthiness.

3. The case study: Developing a Visual Representation of Intellectual Capital

The METI set up a research committee that focuses on "investigating and researching credit technologies that utilize evaluation corporate technologies.*" in the 2008 fiscal year. The METI committee involved survey research from 429 lenders (4 Mega banks, 85 Tier I and II Regional banks, 247 cooperative banks, 82 Credit Unions, and 11 other financial institutions). Before sending questionnaires to lending institutions, committee members first discussed which IC items are representative of corporate technologies involving intellectual properties, networks, organizations, as well as corporate technological strategies. This list of IC items was in reference to interview surveys from 6 regional and cooperative banks conducted by the SMRJ in late 2007 (Yosano and Koga, 2008, Yosano and Nakaoka, 2011).

3.1 Sample and Methodology

Our study focuses on the lenders' development of trustworthiness by utilizing IC information, and therefore, our study sample only involves 4 Mega Banks, 85 Tier I and II regional banks, and 247 cooperative banks. It excludes the 82 Credit Unions and 11 other financial institutions used in the METI survey. Our sample size totaled 336 lenders.

Table 1 shows the utilization level of IC information for creating trustworthiness during the lending process. 1 = "No usage level," 2 = "Weak Usage level," 3 = "Medium Usage level," 4 = "Strong Usage level," 5 = "Extremely Strong Usage level."

The MEasuRing Intangibles To Understand and improve innovation Management (MERITUM) coalition introduced intangible concepts as the following: human capital, structural capital, and relational capital. In March 2002, the Japanese government introduced propaganda to "strengthen industrial competitiveness and promote intellectual property policies," in order to coincide with a technologically driven economy. Our survey data from METI 2008, also focuses on how Japanese technologies relate with networks, including customers, suppliers, government/municipal offices, and R&D affiliates. Therefore, it was logical for us to isolate the technology factor apart from the structural capital factor. We further separated the corporate strategy from structural capital, because it is by definition a corporation's business policies for the future and the decisive way for a corporation to continue through the changing market. Hence, we updated the MERITUM intangible structural capital term into three factors: corporate strategy, technology, and organizational structure. We also updated the definition of relational capital to encompass the network factor as a boundary influence rather than an internal concept. These four concepts, corporate strategy, technology, organizational structure, and networks, are then considered along with human resource capital to total 5 IC factors used in our study. We show our updated intangible factor concepts in Figure 1. Therefore, we combined 5 corporate strategy IC items, shown in Table 1 and found on the Likert scale that measures credit decider attitudes toward usage, into one corporate

strategy factor (cronbach alpha⁴ = 0.9007). 9 organizational structure IC items were combined into one organizational structure factor (cronbach alpha = 0.8776), 3 employee IC items into one human resource factor (cronbach alpha = 0.9751), 23 technological and intellectual property IC items into one technology factor (cronbach alpha = 0.9740), and lastly, 15 network IC items into one network factor (cronbach alpha = 0.9452). All of these factors are shown in Table 1.

[Table 1 Insert Here]

3.2 Methodologies and factor analysis results

We conducted factor analysis in order to extract the primary, latent factor present in each category. The corporate strategy factor has a primary factor whose eigenvalue⁵ is 2.41299 and to a 0.8043 proportion⁶. The organizational structure factor has a primary factor whose eigenvalue is 5.04378 to a 0.5604 proportion. The human resource factor has a primary factor whose eigenvalue is 2.41299 to a 0.8043 proportion. The technology factor has a primary factor whose eigenvalue is 9.63748 to a 0.7413 proportion. Lastly, the network factor has a primary factor whose eigenvalue is 8.57670 to a 0.5718 proportion.

[Figure 1 Insert Here]

Internally, within the corporation, the correlation between the organizational structure factor and the human resource factor is 0.6199***⁷, the correlation between the

⁴Cronbach alpha is a coefficient for reliability. It is commonly used to measure the internal consistency or reliability of a psychometric test score for a sample of examinees. Here, for example, 0.9007 means that over 90% of the examinees in our sample, who are representative of lenders, consider our corporate strategy category, containing 5 IC items, as a primary factor.

⁵ Eigenvalue measures the variance between all the variables that are accounted for within a factor.

⁶ Proportion shows the degree to which a primary factor variance can explain the variance of all the individual variables. Here, for example, the primary corporate strategy factor's variance explains over 80% of all five IC items' variance.

⁷ *** denotes 1% significance level for the rejection of the null hypothesis: the organizational structure factor is equal to the human resource factor.

organizational structure and the technology factor is 0.8022***, the correlation between the human resources factor and the technology factor is 0.6674***.

Between the corporation and its boundary networks, such as suppliers, customers, R&D co-developers, and government and municipal offices, the correlation between the organizational structure factor and the network factor is 0.6261***. The correlation between the human resource factor and the network factor is 0.5103***, and the correlation between the technology factor and the network factor is 0.6655***.

We are able to address that the latent factors within the corporation, especially for SMEs, are highly correlated with the boundary network factor (1% significance level). We are able to interpret this Japanese lender practical phenomena from the three following philo-sociological view points.

Last, we combined three primary factors: the organizational structure factor, the human resources factor, and the technology factor into one primary internal corporate factor. We found that this comprehensive factor has a 2.40409 eigenvalue to a 0.8014 proportion.

Foucault (1980) presented that the corporate phenomenon is created by “conditions of possibility.” He suggests that we can map or predict conditional events in the future, meanwhile, in actuality corporations have resources, such as human resources, an organizational structure, technologies, and boundary organizational networks. These present-day resources help drive corporations into the future, but how they are used is determined by the corporate strategy.

“Past and future are living in the present. Whatever human beings do in the present is decisively influenced by the past and by the future...the future is not something that will come later, independently of our will. There are several possible futures and one of them as to be made (Markovic, 1974, pp. 10-11).”

If the corporate strategy is flawed, then the corporation is at risk for bankruptcy. On the other hand, if the corporate strategy is successful, then the corporation will have glorious future prospects. This delicate relationship between the corporate strategy and corporate resources will actually determine whether or not the corporation will be able to fully utilize their corporate resources toward the most promising future. Therefore, we would like to sketch the relationship between the corporate strategy and internal corporate resources in addition to boundary organizations or networks (the details of this analysis is shown in Figure 1).

The correlation between the corporate strategy and the boundary network factor is 0.6175***, and the correlation between the corporate strategy and the primary internal corporate factor is 0.8123***. The internal corporate and boundary factors are highly correlated with the corporate strategy factor (1% significance level). With this data, we are able to suggest that lending practices definitely notice the relationship between the corporate strategy and the internal corporate and boundary network latent factors. Therefore, the corporation needs the strategic viewpoint that the internal and boundary factors should produce in order to enhance the strategic corporate business purpose.

4. Conclusion

After updating the MERITUM intangible concept terminology, we were able to analyze our hypothetical concept that the corporate strategy determines whether or not internal resources, human resources, the organizational structure, technology, and boundary networks are utilized fully. This phenomenon was also supported by “investigating and researching credit technologies that utilize corporate evaluation technology.” Our updated concepts support not only our hypothetical concept, but our data analysis of the surveys provided by the METI 2008 investigation also supports our hypothetical issue that network information helps to create trustworthiness with lenders.

Our empirical findings are as follows: First, Japanese lenders who judge the creditworthiness of firms, place a great deal of importance on network boundary information in comparison to human resources (human capital) and technology (structural capital). Second, while Japanese lenders confront difficulties in accessing

and evaluating a firm's human resources and technology, they comprehend that both resources are essential performance generators for firms. Third, lender perceptions show that both human resources and technologies are highly correlated to the larger network information. How do we interpret these local practices from various perspectives in order to further our understanding of the effects of intellectual capital at large? How do we analyze this local phenomenon to help explain the surrounding societal context?

Why do lenders primarily focus on network information? If we interpret this local phenomenon from a dominant Western philosophical and scientific perspective, that is, in a rationalistic manner, the functional reasoning leads us to postulate that lenders are efficient, rational decision makers. Therefore, we can further hypothesize that lenders use networks rationally as a proxy for human resources and technology, in order to optimize their ability to make a fully educated judgment about the borrowers' trustworthiness. Lenders are constantly trying to overcome obstacles through a rational manner in order to maximize their investment profitability. Lenders are not only evaluating human resources and technology independently, but they are also using other "market" partner impressions of the target firm's capabilities and trustworthiness.

If we interpret this phenomenon from the Western critical perspective, that is, in the New Institutionalism (e.g. Powell and DiMaggio, 1991), adopted in the 1980s, we can conclude the following: Lenders make decisions in accordance with social norm determinants, rather than for personal optimization. In other words, lenders make judgments through the social dialectic between individuals creating a larger social influence of habit. Why do lenders focus primarily on network information? We propose that lenders rely heavily on the macro structure of their social context, because, ironically, the social context trains lenders to distrust human resources and technological measures, and rather, use network information as a lens into the credibility of a prospective firm. However, the construction and reconstruction of other measures creates continuous dialectic of measurement problems.

Another possible pragmatic interpretation of the phenomenal use of network information from the more traditional philosophical awareness and rejection of the

perfect measurement idea from before the 1990s can be as follows: Lenders make decisions based on their daily practice and reflection on firms' human resources and technology within the socially shared context. The numerical controls, calculations, and probabilities, used as basic techniques, are not understood as exact depictions or predictions, but rather as a rough, yet practical approximation for the moment. Observing borrower human resources and technology through networks produces the closest approximation of the lenders' socially shared context: the measurements are treated as a part of the social context and reality that counts for their business. The ultimate concern for lenders is the practical effects of their approximations, and the pros and cons of their decision making. Lenders simply try to make their business work within the local social and cultural context, and therefore, they treat the client's perceptions as the most valid reality for consideration.

[2011.12.2 1066]

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Table 1

| | | Mean Value | Standard Deviation |
|---|--|------------|--------------------|
| Corporate Strategy 2.84 | Whether the firms make the most of their uniqueness and specialties in technology when outlining their business plan. | 3.1671 | 0.7416 |
| | Whether the firms utilize their intellectual properties strategically. | 2.5594 | 0.7254 |
| | Whether a complete switch of products/services is needed with the adoption of technologies. | 2.8696 | 0.7415 |
| | Clarify and improve corporate revenue by utilizing technologies and intellectual property. | 2.5860 | 0.6950 |
| | Management comprehension of technology. | 3.2529 | 0.7578 |
| Cronbach Alpha = 0.9007 | | | |
| Organization Structure 2.56 | Completion of R&D equipment. | 2.7778 | 0.7486 |
| | Brand power or profit margin, based on the high level of technology. | 2.8596 | 0.7834 |
| | Training program for technology department employees. | 2.3801 | 0.6947 |
| | Technology conformity to the market demands. | 2.9912 | 0.7914 |
| | The use of the quality management system (ISO, etc). | 2.9329 | 0.7521 |
| | Systematized, and/or visualized technological know-how (The construction of a database, the spread of an employee training manual, etc). | 2.2874 | 0.7232 |
| | The construction of security systems to prevent technology leaks (The security management, etc). | 2.1313 | 0.7115 |
| | Actual results of the public grant and/or awards. | 2.8805 | 0.7800 |
| Incentive system for an invention (salary, bonus, and personnel evaluation, etc). | 2.1848 | 0.7619 | |
| Cronbach Alpha = 0.8776 | | | |
| Human Resource 2.52 | The expertise and experience level of senior workers and the rank and file in the engineering and/or strategic planning department. | 2.6531 | 0.7831 |
| | The explicit and implicit knowledge, morale, and motivation of senior and junior workers in the engineering and/or planning department. | 2.4797 | 0.8079 |
| | Qualified employees. | 2.5652 | 0.7209 |
| Cronbach Alpha =0.9751 | | | |

Table 1 (continue)

| | | | |
|-------------------------|--|--------|--------|
| | Undefended technological know-how (business secret). | 2.4052 | 0.8177 |
| | The superiority over other same products and/or technological areas. | 3.0554 | 0.8549 |
| | The level of barriers for new entry. | 2.6210 | 0.8106 |
| | The product life cycle (The period which the product produces the revenues). | 2.6181 | 0.7854 |
| | Innovation of core technologies. | 2.6550 | 0.8720 |
| | The price superiority of core technologies. | 2.6696 | 0.8418 |
| | The functional superiority of the technologies. | 2.6862 | 0.8633 |
| Technologies 2.40 | The possibility of expanding the application of the core technology and business model. | 2.5205 | 0.8343 |
| | Time frame when the product/service (which is based on the technologies) will find its market. | 2.5310 | 0.8148 |
| | The possibility of product/service commercialization which is based on the core technology and business model. | 2.4164 | 0.8382 |
| | Whether the core technology is easily copied or imitated. | 2.3695 | 0.8251 |
| | Whether the core technology is heavily dependent on the specific qualified expertise. | 2.3724 | 0.8184 |
| and | The relationship between the core technology and surrounding technologies. | 2.5029 | 0.8001 |
| | The number of patents. | 2.7668 | 0.8260 |
| | The number of annual applicants and/or legislative patents. | 2.3265 | 0.7636 |
| | The actual results of licensees. | 2.3343 | 0.7608 |
| | The economic value of the patents. | 2.3275 | 0.7529 |
| | The patent portfolio for the product. | 2.1559 | 0.7179 |
| | Whether the patent is core or close to core. | 2.0909 | 0.7158 |
| Intellectual Propeties | Whether the core patent needs application for the surrounding patents. | 2.0497 | 0.7022 |
| | Whether the patent is easily copied or imitated. | 2.1199 | 0.7145 |
| | Whether the patent is heavily dependent on the specific qualifying expertise. | 2.1667 | 0.7133 |
| | The economic value of the unused patents. | 2.0175 | 0.7344 |
| Cronbach Alpha = 0.9751 | | | |

Table 1 (continue)

| | | | |
|-------------------------|---|--------|--------|
| | The relationship with retailers (retail sellers and wholesalers). | 3.6250 | 0.8128 |
| | Whether the firm has already captured the target market. | 3.7594 | 0.8195 |
| | Small customer base (Whether the firm relies exclusively on a small number customers). | 3.3536 | 0.8227 |
| | Whether the relationship with existing customers is regular or irregular. | 3.3942 | 0.8325 |
| | Coordination with the developers and engineering firms. | 2.6481 | 0.7855 |
| | Coordination with the product/service design firms. | 2.6481 | 0.7742 |
| | Coordination with the manufacturing firms. | 2.6158 | 0.7085 |
| Networks 3.12 | The relationship with suppliers. | 2.7281 | 0.7990 |
| | Collaboration regarding research within the firms. | 2.7843 | 0.7610 |
| | Collaboration regarding distribution within the firms. | 2.7310 | 0.7644 |
| | Collaboration regarding research with universities and public (government) research institutes. | 3.0580 | 0.7717 |
| | The support system of specialists, such as lawyers, patent agencies, and consultant engineers. | 3.8353 | 0.9035 |
| | The relationship with government and municipal offices. | 2.8513 | 0.9450 |
| | The relationship with other lenders. | 3.6676 | 0.8761 |
| | The relationship with equity holders. | 3.6928 | 0.8481 |
| Cronbach Alpha = 0.9452 | | | |

Figure 1

