

The horizontal division and vertical integration of business models and turnaround management of Japan's electronics manufactures

Yousin Park and Yunju Chen

Abstract—This paper discusses the horizontal division and vertical integration of business models and turnaround management of Japan's electronics manufactures in the view of groups' interorganizational relationships. We visualize and examine the group structures of Panasonic and Sony by social network analysis before the massive losses in 2011. Our findings will give insights for examining the turnaround possibility of Japanese electronics manufacturers through reorganization of interorganizational relationships.

Keywords—*Horizontal and Vertical Integration Business Models, Social Network Analysis, Panasonic, Sony*

I. INTRODUCTION

JAPAN'S electronics manufactures, one of the world's most competitive industries, has recorded massive losses after-tax in fiscal 2011. It was primarily the result of sluggish performance in the production of TV sets, Japanese manufacturers' flagship products. Some newspapers pointed out that Panasonic and Sony's late actions for concentration in core competence among large amounts of businesses were the main reason leading to the massive losses. Other competitors such as Hitachi and Toshiba shifted their core businesses to profitable domains at an early stage so that they could avoid the losses.

Panasonic (formerly known as Matsushita Electric Industrial Co., Ltd.), the leading TV sets manufacturer in Japan, especially urged to escape from the current slump. Many economists predicted it would be hard for Panasonic to recover this time, whereas it is not the first crisis that Panasonic has to cope with. In the past, this company's drastic turnaround was successfully achieved and well-known as the "2001 Reform". Panasonic recovered its profitability by concentrating its core business and changing the relationships with its subsidiaries and other cooperative firms. The structure of the group became more integrated and centralized [1][2].

Our previous researches indicated that if Japanese companies want to attain substantial and consecutively positive change in performance, they have to reevaluate their interorganizational relationships because in Japan companies generally engage in long-term transaction relationships (Chen & Park, 2009; Park and Chen, 2010). Up to now, there are few researches of corporate turnarounds providing such point of view for analysis.

Panasonic restructured its group businesses after 2001 and achieved a successful corporate turnaround, but it is said that the slump in 2011 was due to Panasonic's failure in concentrating its core competences. We would like to set our first research question: What were the

business structures of Panasonic and Sony group then in before 2011? Here we use two kinds of quantitative analysis: ROIC (Return on Invested Capital) and Social Network Analysis (Centrality Analysis). Index of ROIC is provided to review the relationship between the shifts of performances and turnarounds (primarily layoff). Since the scope of interorganizational relationships is necessary to examine the group structure, social network analysis is an effective quantitative method to make whole interorganizational relationships of a corporate group visible and countable.

The second research question: How the group structures affect the result of corporate turnarounds? Since corporate turnaround seeks to redefine the company's business model so that the performance can be improved, it is necessary to examine the relationship between corporate turnaround and business model. Panasonic and Sony Groups represent two different kinds of organizational structures so that we compare their differences by social network analysis and discuss their implications for corporate turnarounds. Our paper ultimately aims to answer the turnaround possibility of Japanese electronics manufacturers, and thus is an exploratory study to reveal the group relationships of Panasonic and Sony's before 2011.

II. OUTLOOK OF THE PREVIOUS RESEARCHES

Turnaround refers to a situation that companies recover their performance while they suffer serious profit decline, business crisis etc. So far many researchers have studied the various factors of crises and strategies/methods of turnarounds [3]. For example, Slatter & Lovett (1999) indicated seven factors for recovery process: stabilization of the crisis, leadership, stakeholder's supports, strategic focus, organizational reform, reform of core-process, financial restructuring [4]. Although Slatter & Lovett pointed out that organizational reform and reform of core-process are essentials for corporate growth during the turnaround period, they did not provide insights into the management of organizational structures. In addition, in these turnaround researches, little was mentioned about the timing that companies take actions for restructuring in turnaround process.

Using the social network analysis, Chen and Park (2009), Park and Chen (2010) visualized the relationships of Panasonic Group after its corporate reform 2001 and indicated some critical issues while analyzing Japan's corporate turnaround cases. Such as: how to handle the relationships with long-term cooperative companies and the multi-diversification businesses. Panasonic's turnaround was found to reduce and centralize transactions to some important affiliated firms in 2002. From the result of network analysis, Panasonic was supposed to share important resources only inside the group and prevents a technology spillover to others.

As the previous researches indicated, to manage the turnaround, a company, actually a corporate group has to carry out not only the internal reform, but also inter-firm reform. A corporate group consists of a parent company, which occupied the central position in the group, and subsidiary corporations that have the relationships with their parent in capital, human resource, and transaction aspects. Recently,

Yousin Park is with the Prefectural University of Hiroshima, Hiroshima, Hiroshima, Japan (e-mail: ecventure72@pu-hiroshima.ac.jp).

Yunju Chen is with Shiga University, Hikone, Shiga, Japan (e-mail: yun-chen@biwako.shiga-u.ac.jp).

large companies derive many subsidiaries and affiliated corporations with capital relations, and allocate related businesses to those corporations to pursue certain growth and profits [5]. So carefully balancing vertical integration and strategic outsourcing (horizontal division) when organizing for innovation helps firms to achieve superior performance [6][7]. Specially, management with a supply chain strategy required integration and outsourcing, and it based on value chain that firms integrated and outsourced with customers and suppliers in value network [8].

In this sense, the scope of interorganizational relationships is inevitable and necessary for turnaround analysis. In this paper, we adapt the view of group level with interorganizational relationships in examining the turnaround management of Japanese electronics manufactures.

III. RESEARCH METHODS AND DATA

In this study, the research methods include 2 kinds of quantitative analysis. First, we calculate the index of ROIC each year and then review the correlation between ROIC and the number of employees in the same year. ROIC can refer to the index of performance, which is defined as net operating profits less adjusted taxes (NOPLAT) over the invested capital of the enterprise (IC), where IC is the sum of the company's equity and debt [9]. We describe the calculation of ROIC in more detail below:

$$\text{ROIC} = \text{NOPLAT}/\text{IC}$$

$$\text{NOPLAT} = \text{revenues} - \text{cost of goods sold} - \text{operating expenses} - \text{depreciation charges} - \text{adjusted taxes}$$

$$\text{IC} = \text{value of shareholders' equity} + \text{value of debt}$$

By examining the correlation between the employee numbers and ROIC, whether a company implements layoff or not will be estimated. If layoff is effective for turnaround, there will be a negative correlation between the employee numbers and ROIC. The data stream collected from 2000 to 2008.

The other method is the social network analysis based on graph theory. According to graph theory, Network Centrality is a concept that can indicate which occupies critical positions in the network. Centrality is one of the well known indexes in this field. The most frequently quoted Freeman's (1979) centrality measures are degree, closeness and betweenness [10]. The degree centrality defined as the number of ties that a node has with the others. Indegree along with outdegree are two respective measures that degree centrality has. Indegree is a count of the number of ties directed to the node and outdegree is the count of opposite directions. In case of a valued graph, the indegree would be the sum of tie values flowing into the node. The indegree of node A received from node B is simultaneously the outdegree of node B (received from node A).

A business network refers to a set of two or more connected business relationships, where each exchange relation is between business firms that are conceptualized as collective actors [11]. The relation means that resources exchanged can be of many types, including tangibles such as goods, services, or money, or intangibles such as information, social support, or influence [12].

We focused these data which capital and transactions relationships of Panasonic Group was collected from IRC's *The Actual Situation of Matsushita Group*: 2006 edition (Panasonic was used after 2009) while Sony's was from the same report series *The Actual Situation of Sony Group*: 2005 edition [13][14]. The data shows the situation after the treatment of Panasonic and Sony for the IT bubble in 2001 but before 2011. We use the items of "Main Shareholder" and "Main Customer", and define the data as "1" if group companies have the relationships with other companies in capital and transaction aspects, otherwise "0". In addition, the company name is based on IRC's printings. We then input the data into matrix table, and the data was

analyzed by the software UCINET 6.0. In this study, the results are mainly introduced by the degree centrality.

A. Case Study and Analysis

Japanese management is characterized long-term relationships, such as relationships on employment, transaction, and capital etc. Panasonic is one of the typical firms which their management styles refer to as Japanese management. Founded in 1918, Panasonic has grown in the base of home electronics, and then diversified its business into material, devices, non-electronic products and services such as home renovation services. It is said that Panasonic is a vertical integration company. Panasonic was also famous for its divisional organization structures because Panasonic used to let several business divisions to produce the same products. This mechanism increased Panasonic's market share, however, duplicative business has become serious problem since the end of 90s. After Panasonic made Matsushita Electric Works Co., Ltd. and Sanyo Electric Co., Ltd. wholly-owned subsidiaries in 2011, Panasonic continually faces the problems of integrating its divisions and reorganization.

On the other hand, Sony Corporation business segments consist of audio, video, communications and information technology products for the consumer and professional markets. Music, pictures and computer entertainment operations, finance etc. are other respective business divisions in the group. Sony was the pioneer to adapt the divisional company organization structure in 1994. It is because Sony is a more highly global-oriented company, and in order to handle many unrelated businesses, it adapts structures somewhat different with Panasonic. However, Sony encountered a slump since 2000s. How to reorganize the unprofitable businesses and recover the competence in information home appliance business are critical issues for Sony.

B. The Restructuring of Sony and Panasonic

Figure 1 presents the shift of ROIC and the number of employees of Panasonic and Sony Groups. Panasonic had a drastic ROIC down in 2002. After the 2001 reform, Panasonic's ROIC recovered and keeps growing. Although 30,000 employees were downsized in the 2000-2004 period, 50,000 employees increased due to the internalization of Matsushita Electric Works Co., Ltd. (now Panasonic Electric Works: PEW). The decrease of the number of employees from 2004 again mentions that lay-off was exercised continually and effectively in Panasonic's restructuring until 2008.

Sony also encountered a drop of ROIC in 2006. Sony seems to downsize its workforce after 2001's IT bubble until 2004, but the number of employees still increases even after 2006. We cannot confirm whether Sony implemented turnarounds successfully or not because the number of employees still increases even after the down of ROIC in 2006. However, Sony announced the plan for restructuring by downsizing the workforce in 2012.

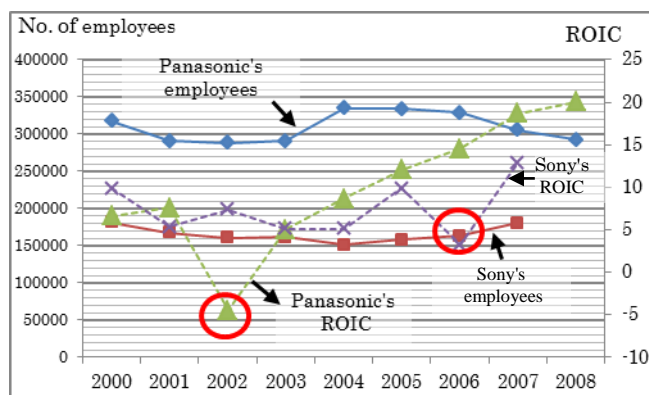


Figure 1: The shift of ROIC, and the number of employees of Panasonic and Sony groups

C. The Group Structures of Sony and Panasonic

We conceptualize the business models of Panasonic and Sony by examining the capital and transaction relationships of the two groups. Based on the data provided by IRC, we graph the transaction networks of Panasonic and Sony by centrality analysis. Table 1 is the list of transaction network of Sony and Panasonic. From the table, we can see that not only the subsidiaries but also the suppliers, Panasonic have more numbers of companies in the network than Sony.

Sony (2004)			Panasonic (2005)		
Node Number	Class	Firms	Node Number	Class	Firms
1-33 (33)	Sony Group	Sony Corp., Sony Music Entertainment etc.	1-65 (65)	Panasonic Group	Matsushita Electric Industrial Co., Matsushita Electric Works etc.
34-467 (434)	Sony suppliers	Matsushita Electric Industrial Co., Cannon, SDS etc.	66-625 (569)	Panasonic suppliers	Alps Electric, Kyocera, Corporation, Seiko Instruments, etc.

Table 1: The constituents in Sony's and Panasonic's Networks

The capital networks of Sony and Panasonic are visualized in Figure 2 and Figure3. It is obviously that the central nodes of both networks were the parent companies. However, Panasonic also held capital relationships through many subsidiaries while Sony mainly invested its businesses through the parent company directly.

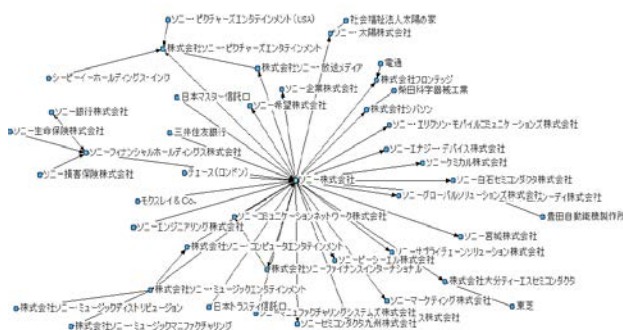


Figure 2: The capital network of Sony group in 2004

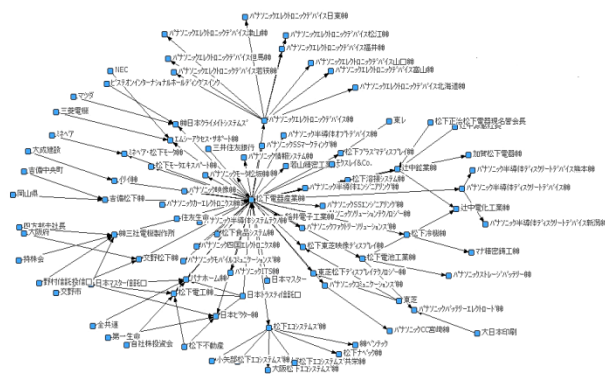


Figure 3: The capital network of Panasonic group in 2005

Figure 4 is the transaction network of Sony in 2004. Transaction network consists of parent company, affiliated firms (subsidiaries), and cooperative suppliers. Figure 2 presents that the parent company of Sony, along with Sony's subsidiaries, such as Sony EMCS Corporation, Sony Energy, Sony Chemical Corporation (now Sony Chemical & Information Device Corporation), are the central nodes in the Sony's network. These companies are observed to be Sony's

devices-related subsidiaries. Besides Sony's subsidiaries, rival companies, such as Panasonic, Sharp, and Toshiba etc. also played as central nodes in the network.

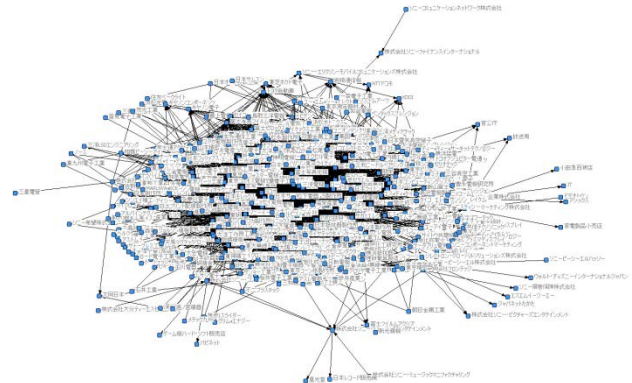


Figure 4: The transaction network of Sony group in 2004

Figure 5 shows that in Panasonic's transaction network in 2005, Matsushita Ecology Systems Co., Ltd., Matsushita Battery Industry Co., Ltd., Sansha Electric Manufacturing Co., Ltd., and Matsushita Electronic Devices Co., Ltd.(?) are the central nodes companies in the network. This means that the core divisions, material and devices-related subsidiaries had high degree of centrality, whereas quite similar to Sony's situation.

However, the constituents of transaction networks of Sony and Panasonic Group somewhat differed from each other in subsidiaries numbers and attributes. If we broaden the transaction relationships to cooperative companies (suppliers), rival companies occupied much proportion among the central nodes in Sony's network. On the other hand, few rival companies were found in Panasonic's Network, and most of the central nodes companies were subsidiaries.

Matsushita Electric Works (now PEW) and Victor Company of Japan, Limited (JVC) have high indegree in the network. However, PEW became wholly owned subsidiaries of Panasonic in 2011, and JVC was deconsolidated from Panasonic Group in 2008.

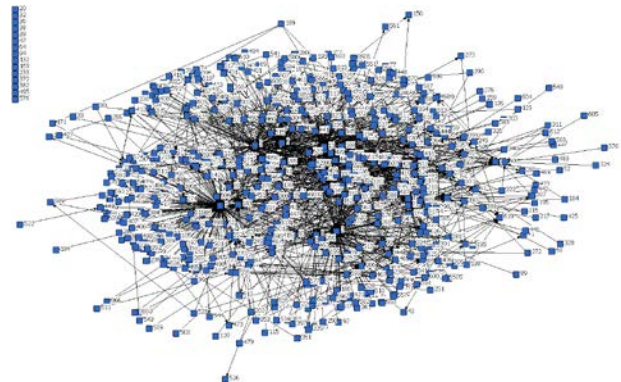


Figure 5: The transaction network of Panasonic group in 2005

Table 2 is the degree centrality on capital relationships of Panasonic and Sony Groups. The degree centrality was used to examine the structures of Sony and Panasonic's networks, especially capital and transaction ones. The indegree indices were calculated in the amount of investments and the rate of it to total investments, which the former is absolute frequency measure and the latter is a relative frequency index. The rate of indegree was introduced because the sizes of networks were different and the rate could indicate the importance of a node in a network.

Since the degree centrality is defined as the number of ties that a node connects, it is obviously that the degree centrality of Sony

Corporation, the parent company of Sony Group, ranked at the top in the network. Other consolidated companies such as Sony Music Entertainment Inc., Sony Financial Holdings Inc. also rank high but their amounts of investments are much fewer than their parent company. Panasonic almost had the same capital relationship structure with Sony. Besides the parent company, the consolidated companies with high degree of centrality were Matsushita Electronic Devices Co., Ltd., and Matsushita Ecology Systems Co., Ltd., etc.

The parent companies of Sony as well as Panasonic played as the central role in the capital networks. However, the companies with high degree centrality in Sony Group were non-information home appliance divisions such as music and finance related ones. It is different from Panasonic Group, which has high degree centrality in devices and air conditioner divisions.

Sony (2004)		Panasonic (2005)	
Firm	No. of investments (rate)	Firm	No. of investments (rate)
Sony Corp.	25 (54%)	Matsushita Electric Industrial Co., Ltd	41 (43%)
Sony Music Entertainment Inc.	3 (6.5%)	Matsushita Electronic Devices Co., Ltd.	9 (9.4%)
Sony Financial Holdings Inc.	3 (6.5)	Matsushita Ecology Systems Co., Ltd	6 (6.35)

Table 2: The degree centrality on capital relationships: Sony and Panasonic

Table 3 and Table 4 are the transaction networks of Sony and Panasonic including the relationships with subsidiaries and cooperative companies (suppliers). In the transaction network, indegree means the number of transactions received from other companies in the network.

Companies who have high indegree can be seen as the assembler of the network. On the other hand, companies with high outdegree mean that they supply products to other companies in a network.

Sony (2004)		Panasonic (2005)	
Firm	No. of transactions (rate)	Firm	No. of transactions (rate)
Sony Corp.	286 (10.388%)	Panasonic Corp.	197 (13.4%)
Sony EMCS Corp.	267 (9.7%)	Matsushita Electronic Devices Co., Ltd.	146 (9.9%)
Matsushita Electric Industrial Co., Ltd. (Panasonic)	215 (7.8%)	Panasonic Communications Co., Ltd.	124 (8.3%)
Toshiba Corp.	190 (6.8%)	Panasonic Mobile Communications Co., Ltd.	119 (8.0%)
Sanyo Corp.	172 (6.2%)	Victor Company of Japan, Ltd.	118 (8.0%)

Table 3: The Indegree of transaction networks: Sony and Panasonic

From Table 3, Sony Corporation., Sony EMCS Corporation along with rival companies such as Matsushita Electric Industrial Co., Ltd (Panasonic), Toshiba Corp., Sanyo Corp. had high indegree in the network of Sony in 2004 were confirmed. In Panasonic transaction network of 2005, the companies with high indegree were the parent company, Matsushita Electronic Devices, Panasonic Communications

Co., Ltd., Panasonic Mobile Communications Co., and Victor Company of Japan, Ltd., etc.

The rate of transaction weight listed in Table 3 indicates that Panasonic concentrated its transactions heavily on the parent company and devices-related subsidiaries, while Sony transactions network was distributed by his rival companies. Both the parent companies of the two groups were the main assemblers and distributors in the networks. Panasonic Group weighted 13.4% of the transactions in the network of 2005. The weight was much higher than Sony Corp.

Table 4 is the outdegree of Sony and Panasonic's transaction networks. In the transaction network of Sony in 2004, KOA, Yokowo Co., Ltd., Ishizuka Electronics Corporation (now SEMITEC Corp.), Enplas Corp. and Tamura Corp. were in high outdegree. Companies in Panasonic's transaction network that have high outdegree were Kyosha Co., Ltd., Shimoda Group, Tamura Corp., Ontec Co., Ltd. (now Ontec), and Shindengen Co., Ltd..

Sony (2004)		Panasonic (2005)	
Firm	No. of transactions (rate)	Firm	No. of transactions (rate)
KOA	27 (5%)	Kyosha Co., Ltd.	16 (5.9%)
Yokowo Co., Ltd.	19 (3%)	Shimoda Group	15 (5.5%)
Ishizuka Electronics Corp.(SEMITEC)	18 (2.8%)	Tamura Corp.	14 (5.0%)
Enplas Corp.	17 (2.6%)	ON Electric Co., Ltd. (Ontec)	12 (4.1%)
Tamura Corp.	17 (2.6%)	Shindengen Co., Ltd.	11 (3.7%)

Table 4: The Outdegree of transaction networks: Sony and Panasonic

Take a more detail look on the attributes of the companies. The attributes of companies with high outdegree, which were the main suppliers, in the two groups were different from each other. Companies who provide products to Sony concentrated in materials, devices fields. For example, KOA provided resistors; Yokowo Co., Ltd. was an antennas and connectors manufacturer etc. In the case of Panasonic Group, the companies who have high outdegree characterized device manufacturers; such as Kyosha Co., Ltd. was a printed wiring board manufacturer, ON Electric Co., Ltd. was a printed circuit board company etc.

IV. DISCUSSION

Here, we examine the structural conditions of Panasonic and Sony group then in before 2011. We first check the ROIC if turnarounds were implemented before 2011, then compare the two groups' structures by social network analysis. Finally, the implications for the possibility of turnarounds of Panasonic and Sony will be discussed.

By reviewing the shift of ROIC and the change of the number of employees, it was suggested that a revision of the life-time employment system in Panasonic because there was a negative correlation between the employee number and performance (ROIC) from 2000 to 2008. The decrease of the number of employees from 2004 again mentions that lay-off was exercised continually and effectively in Panasonic's restructuring until 2008.

On the other hand, Sony also encountered a drop of ROIC in 2006 but the number of employees still increases even after 2006. As mentioned above, we cannot confirm whether Sony implemented turnarounds successfully or not. Although Sony announced the plan for restructuring by downsizing the workforce in 2012, it might be suggested that Sony responded for reorganization late.

By the centrality analysis of Panasonic and Sony's capital and transaction relationships, we found some differences between them in

several aspects. The differences of the network structures are summarized in Table 5.

On the capital relationships network, the two groups almost had the same capital relationship structure, whereas the parent company of Sony as well as Panasonic played the central role in the capital networks. However, attributes of core nodes are different: non-information home appliance divisions in Sony's network and devices/air conditioner divisions in Panasonic's. In addition, Panasonic invested businesses through its subsidiaries much more than Sony. This can be suggested that Sony is an unrelated diversification company with a horizon capital relationship in the group. Panasonic diverted its businesses into related domains and thus forms vertical and deep capital relationships within the group.

		Sony	Panasonic
Capital Relationships	Core nodes	Parent company as central role in the capital network	Parent company as central role in the capital network
	Attributes of core nodes	Non-information home appliance divisions	Devices and air conditioner divisions
Transaction relationships	Companies numbers	Few numbers of subsidiaries and suppliers	More numbers of subsidiaries and suppliers than Sony
	Core nodes	Devices-related subsidiaries /Rival companies	Core divisions, devices-related subsidiaries
	assemblers	devices-related subsidiaries /Rival companies	parent company and devices-related subsidiaries
	suppliers	materials, devices	materials, devices

Table 5: The comparison of Panasonic and Sony's capital/transaction networks

In the case of transaction networks, Sony and Panasonic groups before 2011 had similar characteristics in the attributes of core nodes companies, but they differed much more in the numbers of network companies, the attribute of core companies, the categories of major assemblers. We discuss this in more detail below.

First, Panasonic had more constituents in the close network than Sony. Second, as the attribute of core companies, although both devices-related subsidiaries were the most important nodes in Panasonic and Sony's transaction networks, there was a big difference between them. The difference was that Sony also relied heavily on rival companies in the open network. Third, the situation was the same in the attribute of the assemblers.

What do these results mean? The transaction network or value chain can be separated into inbound logistics (devices & material), production process, marketing & sales activities. In the case of Panasonic, the parent company of Panasonic and device-related subsidiaries played important roles in all of the value chain activities. The rate of transaction weight at Table 3 indicates that Panasonic concentrated its transactions more heavily on the parent company than Sony. It can be explained that both complete products and devices businesses were important in the Panasonic Group; however, the products were assembled and distributed mainly through the parent company. These features describe that Panasonic is a vertical integration business model.

On the other hand, in Sony's network, although the parent company and device-related subsidiaries were central nodes companies, companies performed in the production process were mainly rival companies. It can be suggested that Sony's transaction network was open and Sony outsourced products from rival companies. In addition,

Sony also concentrated its transactions on parent company so that Sony covered marketing activities. Thus Sony employed a horizontal specification business model. The business modes of both groups are as shown in the following image.

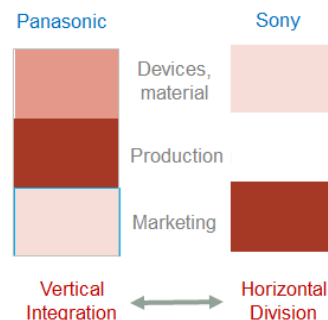


Figure 6: The image of Sony and Panasonic's business models

Since corporate turnaround seeks to redefine the company's business model, in our point of view, to understand the structure (interorganizational relationships) of a company group is important. Our previous research Park & Chen (2010) used the data before and after Panasonic's 2001 reform and found that Panasonic group became more vertical integration than before. Because the index of ROIC improved and went on rising so that the corporate turnaround strategy of Panasonic to become more vertical integration could be indicated effective, at least until 2008. We suggest that vertical integration was not the main reason that caused Panasonic's 2011 loss, however, the strategy for corporate turnaround was constrained by its business model. The analysis on the situation after 2008 is necessary.

On the other hand, as we suggest that Sony responded for turnaround late, Sony's horizontal specification business model might lack the authority power to take actions. Sony and Panasonic's case indicated how the strategy for corporate turnaround was constrained by its existing business model.

V. CONCLUSION

In this paper, we tried to ask two research questions. One was: "What were the structural conditions of Panasonic and Sony group then in before 2011"? The second research question: "How the group structures affect the result of turnarounds"? Using the quantitative methods of ROIC and social network analysis, the empirical findings can be summarized as follows.

For the first research question, characteristics of Panasonic's vertical integration management style and powerful centralization, as well as Sony's diversification into non-electronics business and horizontal specification business model before 2011 are visualized through the social network analysis.

Second, we found how the group structures affect the result of turnarounds. Our previous research indicated that Panasonic group became more vertical integration in its 2001 reform. If we confirm the relationship between the timing for reorganization with the group network structures, Panasonic group's case shows that a more centralized and integrated group structure would be favourable for taking early actions for turnaround.

In addition, we suggest that vertical integration may not be the main reason that caused Japanese electronics companies' failure in 2011. However, the existing business models may be hard to revise and the effectiveness would be limited in corporate turnarounds.

So far, there is little literature captured the differences of group structures between Panasonic and Sony by quantitative analysis tools, nor the corporate turnaround situations that Japanese manufactures were in. This study shows not only the possibility for the using of

social network analysis on the turnaround research but the relationships between business models and turnaround management.

However, our study has some limitations. For example, static data of one year is not sufficient to capture the dynamic changes of business models in turnarounds. Time-series data should be collected and utilized for further analysis. Also, since this study is an exploratory study, more detail examination between performance and business models in corporate turnarounds, questions about how capital, transaction structures of a group affect the results of turnarounds etc. are left for the future works.

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Yousin Park had been in the Department of Business Administration, Ube Technical College until 2012 and has been in the Department of Business Administration, Prefectural University of Hiroshima. He received the B.B.A. from Korea Aerospace University in 1998 and M.B.A. in Economics from Kyoto University, Japan in 2002, respectively. And he also received the Ph. D Degree in Economic, Kyoto University in 2009. His research interests include Management of Innovation, IT management strategy and business-to-business e-commerce.

Yunju Chen is on the faculty of Economics of Shiga University in Japan. She received her Bachelor Degree from National Taiwan University and the Master/Ph.D. in Economics from the Graduate School of Economics, Kyoto University in 2004. Her teaching and research activities focus on the areas of interorganizational relationships, strategic technology management, innovation, and management of corporate turnarounds.