An Analysis of Organizational Behaviors in the Keiretsu of Mazda

Shinya Tagawa[1], Takao Ito[1], Makoto Sakamoto[2], and Shu Quan Lu[3]

1 Dept. of Business Administration, Ube National College of Technology, Yamaguchi, Japan
(Tel : 81-836-35-7115; Fax : 81-836-35-7115)
(ito@ube-k.ac.jp, tagawa@ube-k.ac.jp)
2 Dept. of Computer Science and Systems Engineering, University of Miyazaki, Miyazaki, Japan
(Tel : 81-985-58-7392; Fax : 81-985-58-7392)
(sakamoto@cs.miyazaki-u.ac.jp)
3 School of Economics, Fudan University, Shanghai, China
(lushuquan2000@yahoo.com)

Abstract: The limit cycle is one of the effective tools to analyze organizational behaviors. The authors discuss the background of this research, and explain the outline of the limit cycle. The organizational behavior and velocity history of all companies in the keiretsu of Mazda, Kansai Yokokai, are measured in this paper. Imasen Electric Industrial Co., Ltd, Hi-lex Corporation, and Tokai Corporation are excluded because of lack of data. The organizational behaviors of all suppliers are divided into four patterns using new approach of the limit cycle, and the velocity history are measured in this paper. The authors concluded this paper by indicating the weak point of the limit cycle.

Keywords: Organizational pattern, Limit cycle, Velocity history, Chaos, Keiretsu, Mazda**.**

I. INTRODUCTION

One of the essential issues in corporate management is how to analyze the organizational behaviors. All of statistical techniques are linear model. But most of the organizational bahaviors can be explained better by nonlinear model, because they are not linear. The main contribution of this paper is that the organiaitonal behavior is successfully divided into four different patterns using the limit cycle, and the velocity history of these companies have been measured. The managerial implication of the organizational behaviors and their velocity history are discussed. In this paper, the authors expalin the basic information of Yokokai, and measure the limit cycles and velocity history of all listed companies in the keiretsu of Mazda, Kansai Yokokai. In Section 2, the authors introduce a brief background of this research. The details of the limit cycle will be explained and all of the companies in the Kansai Yokokai have been measured in section 3. In section 4, the authors discuss the results. The authors summarize this paper in section 5.

II. BACKGROUND

New findings in physics and biology have discovered some examples of the chaos [1]. An original index developed in hydrology for the practical matter of determining optimum dam sizing for the Nile river's volatile rain and drought conditions has been published in 1951 [2]. It is a typical nonlinear index and directly related to fractal dimension. In 1992, Tsuda I. et al found a chaotic pulsation in a finger's capillary vessels in normal subjects and psychiatric patients, as well as cardiac chaos [3]. Generally, Chaos would be described as disorder state. But most of the recent findings showed us that chaos is driven by deterministic nonlinear processes, such as hydraulic flow and astronomical phenomena.

Priesmeyer H. R. and Baik K. proposed a new method to discover the pattern of chaos in 1989 [4]. They noticed that organization have characteristic limit cycle like the human heart. Furthermore, Ito T. and Sakamoto M. successfully clarified the relationship between economic development and the velocity history of the typical companies in Japan using the limit cycle [5].

III. MEASUREMENT

1. Data collection

In order to discover the pattern of the organizational behaviors, the authors collected the data from the

keiretsu of Mazda. Like other keiretsu organization, there are three groups of suppliers, Kanto Yokokai, Kansai Yokokai and Nishinihon Yokokai. Kansai Yokokai is one of the most important groups in the keiretsu of Mazda. There are totally 26 listed companies in Kansai Yokokai. The authors focus their analysis on 23 listed companies of Kansai Yokokai, all companies except Imasen Electric Industrial Co., Ltd, Hi-lex Corporation, and Tokai Corporation because of lack of data[i].

2. Results

The authors measured the limited cycle and velocity history of all these companies using a computer program. Fig. 1 and Fig. 2 show the result of limit cycle and its velocity of the selected companies respectively.

IV. DISCUSSIONS AND IMPLICATIONS

In complex systems theory, a set of states, invariant under the dynamics, towards which neighboring states in a given basin of attraction asymptotically approach in the course of dynamic evolution, is called attractor. According to Priesmeyer, there are 4 patterns of chaos in the limit cycle. They can be expressed as Fig. 3 [6].

Compared Fig. 1 with Fig. 2, these companies can be divided into five parts. Sumitomo Electric Industries, Ltd., NTN Corporation, Bando Chemical Industries, Ltd., and Suminoe Textile Co., Ltd. can be considered as Period Two, because these limit cycles are very similar with straight lines. Aisan Industry Co., Ltd. and Chuo Spring Co., Ltd. can be regarded as Period Four. The limit cycles of these companies look like butterfly. And Ashimori Industry Co., Ltd., Exedy Corporation, Owari Precise Products Co., Ltd., Kawashima Selkon Textiles Co., Ltd., Seiren Co., Ltd., Daido Steel Co., Ltd., Daido Metal Co., Ltd., Tsubakimoto Chain Company, Denso Corporation, Tokai Rubber Industries, Ltd., NGK Spark Plug Co., Ltd., Matsushita Electric Industrial Co., Ltd. and Mitsuboshi Belting Ltd. can be divided into the group of Period Eight. The limit cycles of these companies look like chaos.

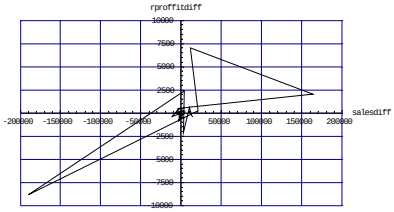
Part of these companies is no equivalent for Fig. 3. For example, Toyoda Gosei Co., Ltd. can be regarded as behavior pattern between period One and Two. And Aichi Steel Corporation, ShinMaywa Industries, Ltd., and Sumitomo Metal Industries, Ltd. can be considered as a group between Period Four and Eight. (See Table 1)

Toyoda Gosei Co., Ltd. is a wholly-owned subsidiary of Toyota. Its capital reaches 28 billion Japanese Yen. It experiences an annual oscillation that reflects proportional changes in performance. And Aichi Steel Corporation and Sumitomo Metal Industries, Ltd. produce specialty steel, forged products, electronic and magnetic parts, and rail automotive and machinery parts such as wheels and break disks, Tubes and pipes. ShinMaywa Industries, Ltd. is engaged in producing special purpose trucks, vacuum systems, automotive wire processing machines, environment systems. These companies are slightly different with other parts-maker. This difference may be considered as the reason why these companies differ from other companies.

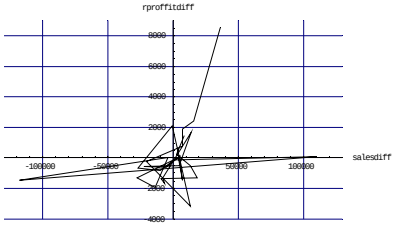
In order to understand the difference between Period Four and Eight, two typical companies such as Denso Corporation and Aisan Industry Co., Ltd. should be considered. Denso Corporation falls within the group of period eight with high-order chaos and unpredictable pattern. Priesmeyer once indicated that "Period 8 limit cycles are common in business. The result from turbulent external environments and management decisions made without knowledge of the structural patterns of change that bind the organization." [6, p.35]. Denso Corporation is one of the important subsidiaries of the keiretsu of Toyota, separated from Toyota Motor Co., Ltd in 1949. Denso Corporation provides its products to not only Mazda, but also Toyota, Honda Motor Co., Ltd, Suzuki Motor Corporation and other automakers. Contrarily, Aisan Industry Co., Ltd. is also one of subsidiaries of Toyota. Compared Aisan Industry Co., Ltd. with Denso Corporation, the dependence from Toyota is very clear. This may be the reason why the behavior of Aisan differs from Denso Corporation.

From Fig. 3, it is easy to find the same change in velocity history for Toyoda Gosei Co., Ltd. and Aisan Industry Co., Ltd. because they are both subsidiaries of Toyota. Basically, it is easy to find the same change of the velocity in the same group.

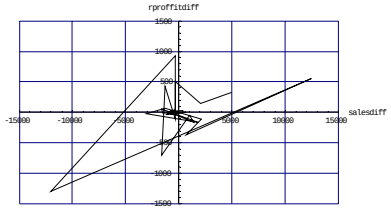
The difference between these two companies can be expressed as follows. The first is the scale. The sales and ordinary profit of Denso Corporation reaches 22,929 billion Japanese Yen and 2,021 billion Japanese Yen in 2006 while those of Aisan Industry Co., Ltd. are 121 billion Japanese Yen and 6 billion Japanese Yen[ii].



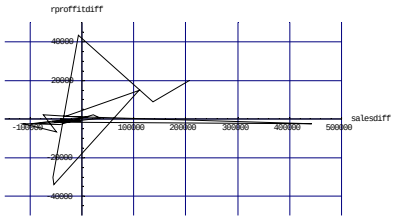
Aisan Industry Co., Ltd.



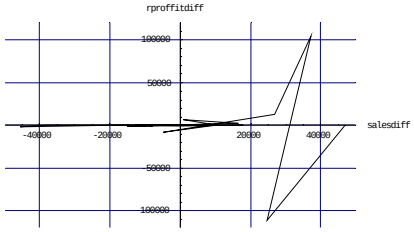
Aichi Steel Corporation



Ashimori Industry Co., Ltd.

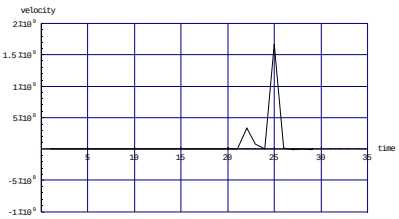


Sumitomo Electric Industries, Ltd.

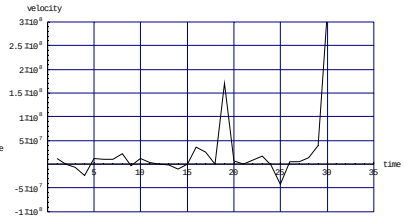


Toyoda Gosei Co., Ltd.

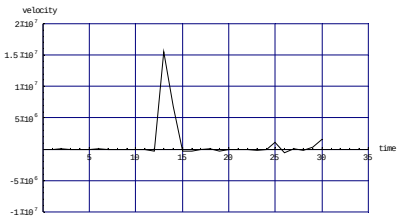
Fig.1 The limited cycle of selected companies in Yokokai.



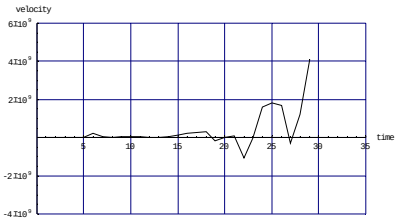
Aisan Industry Co., Ltd.



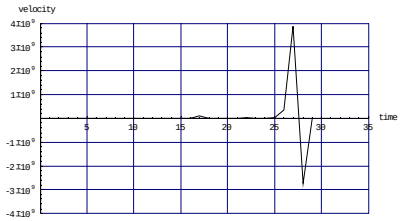
Aichi Steel Corporation



Ashimori Industry Co., Ltd.



Sumitomo Electric Industries, Ltd.



Toyoda Gosei Co., Ltd.

Fig.2 The velocity history of selected companies in Yokokai.

Table 1. Classification of all companies in Kansai Yokokai

Period	Companies
Period One	None
Between Period One and Two	Toyoda Gosei Co., Ltd.
Period Two	Sumitomo Electric Industries, Ltd., NTN Corporation, Bando Chemical Industries, Ltd., and Suminoe Textile Co., Ltd.
Between Period Two and Four	None
Period Four	Aisan Industry Co., Ltd. and Chuo Spring Co., Ltd.
Between Period Four and Eight	Aichi Steel Corporation, ShinMaywa Industries, Ltd., and Sumitomo Metal Industries, Ltd.
Period Eight	Ashimori Industry Co., Ltd., Exedy Corporation, Owari Precise Products Co., Ltd., Kawashima Selkon Textiles Co., Ltd., Seiren Co., Ltd., Daido Steel Co., Ltd., Daido Metal Co., Ltd., Tsubakimoto Chain Company, Denso Corporation, Tokai Rubber Industries, Ltd., NGK Spark Plug Co., Ltd., Matsushita Electric Industrial Co., Ltd. and Mitsuboshi Belting Ltd.

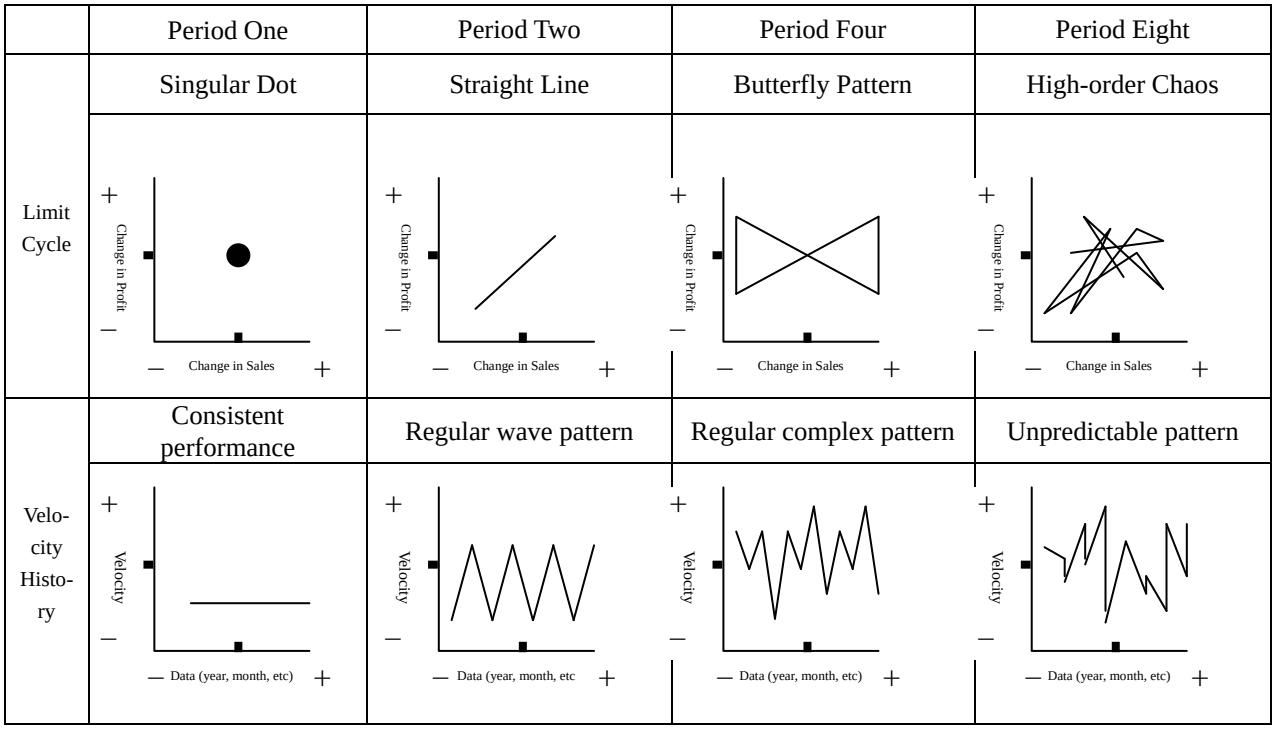


Fig. 3. Limit cycles and its velocity of each period.

The second is the dependence from Toyota. Denso Corporation has a chaotic pattern because it deals with many automakers rather than Aisan Industry Co., Ltd. Compare with Denso Corporation, Aisan Industry Co., Ltd. is one of the subsidiaries under the direct control of Toyota. The difference of scale and independence may be considered as the important factors to determine the different patterns of organizational behavior.

VI. CONCLUSION

The authors measured limit cycle and its velocity using limit cycle theory, and found that difference of scale and independence may determine different organizational behaviors. One of the weak points of limit cycle theory is that it will be very hard to recognize the difference behaviors among the same group, such as Period Eight. Much more measurement is required. To better understand the pattern of different organizational behaviors, much more researches should be developed.

ACKNOWLEDGEMENT

This research was partially supported by the Ministry of Education, Science, Sports and Culture, Grant-in-Aid for Exploratory Research, 21510171, 2009.

REFERENCES

[1]Moon F. C. (1987) *Chaotic Vibrations: An Introduction for Applied Scientists and Engineers*, pp.3, John Wiley & Sons.

[2]Hurst H. E. (1951) Long-term storage capacity of reserviors, *Transaction of the American Society of Civil Engineers*, 116, pp.770-808.

[3]Tsuda I., Tahara T., and Iwanaga H. (1992) Chaotic Pulsation in Human Capillary Vessels and its Dependence on Mental and Physical Conditions, *International Journal of Bifurcation and Chaos*, Vol.2, No.2, pp.313-324, World Scientific Publishing Company.

[4]Priesmeyer H. R., Kibok Baik (1989) Discovering the Patterns of Chaos, *Planning Review*, pp.14-21 and pp.46-47, November/ December 1989.

[5]Ito T. and Sakamoto M.(2007) A Consideration on Limit Cycle Theory, *The papers of Technical Meetings on Information Systems*, IS-07-10～15, pp. 19-23, The Institute of Electrical Engineers of Japan(Japanese Edition).

[6]Priesmeyer H. R. (1992) Organizations and Chaos: Defining the Methods and Management, pp.28-36, Greenwood Publishing Group, Inc.

[i] The authors collected data of Imasen and Hi-lex Corporation from 1996 to 2006, Tokai Corporation from 1988 to 2006 respectively. These data is not s ufficient for analyzing these companies with Limit Cycle theory.

[ii] Webpage of Denso Corporation and Aisan, Industry Co., Ltd., retrieved on 12 November, 2007, from http://www.aisan-ind.co.jp/ company/data.htm and http://www.denso.co.jp/ja/aboutdenso/company/