

# The Advancement of Women's Status at Work—A Complexity Perspective

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*The main purpose of the present study was to explore the change of workplace women's status from a complexity perspective. By adopting the core concepts, self-organizing and nonlinear feedback, from dissipative structure theory and catastrophe theory, the sub-theories of complexity science, this study demonstrated the hidden pattern of the women's status advancement, and provided a rich theoretical explanation of its qualitative change and transition process. The longitudinal data, ranging from 1978 to 2003, was drawn from Human Resource Survey and Economic Statistics, which are released monthly by Directorate-General of Budget, Accounting & Statistics, Executive Yuan, R.O.C.. The geometrical-oriented phase portrait method was employed for data analysis via visualizing the research outcomes. In addition, theoretical implications and suggestions for future research were discussed.*

**Keywords:** Advancement, Catastrophe, Complexity, Dissipative Structure, Nonlinear Feedback, Pattern, Qualitative Change, Self-organizing, Transition Process, Women's Status.

“Word of Millennium” selected by American Dialects Society every year was almost related to “Computer” since 1993. However, it was been changed by the word “She” in 2000s. The increasing importance of women was also reflected from the greater concerns on gender issues among practitioners and scholars. Since women is not only the half of world population, but also the half of potential human resources in organizations.

From labor market point of view, at the job demand side, the nature of work knowledge is continuously changing. In the middle of 20<sup>th</sup> century, management revolution started to influence worldwide organizations in less than fifty years (Drucker, 1994). Knowledge was applied to figure out the effective way for achieving organizational goals. Knowledge works have considered that eliminate the line between genders, thus, women should enjoy more opportunities in workplaces than before. Based on 2003 human development report of the United Nations, the highest percentage of national female manager reached 46% already. On the other hand, at the job supply side, the composition of labor force is also changing. The basic industry was completely shifted to the third industry in the States in past 150 years (Lenski, Lenski & Nolan, 1992). The fastest growing industries predicted by United States Bureau of Labor Statistics (USBLS) including business service, baby caring, health, and retailers, most are female-intensive industries (Fisher, 1999). The similar phenomenon also appeared in Taiwan. The percentage of female employee was 32% in 1980s and grew to 42% in 2003; the percentage of female managers grew from 8% to 15% during the same period of time (General of Budget, Accounting and Statistics, 2003).

In the previous women studies, at least two areas are worthy for further addressed: first, gender issues generally discussed based on a sole discipline, such as economics, sociology, psychology, biology, anthropology, politics, education, organization or management. However, it is hard to be analyzed comprehensively from a single perspective without involving the others due to the issue's inter-discipline nature. Second, various kinds of theory, such as human capital, social discrimination and market segmentation, were used to explain the factors that influence women's status development and to depict the trend of it. However, they provide limited insights on these kinds of questions: Does the change pattern of working women's status exist? Does the qualitative change of women's status occurred except its quantitative change which we could observe directly? Or why the growth speed of female employees and that of female managers is different?

The emerging complexity science might provide a light on the above limitations. The development of women's status in workplace is generally represented by an S curve. In the past studies, scholars focused mostly on the “superficial trend”, including up and down of phenomenon, its key turning point and the influence factors behind. Complexity perspective, instead, focuses on the “hidden pattern” and explores the different states before- and after- system change and its mid-transition process, which are the main theme of this study.

Therefore, the purposes of this study included: first, to demonstrate the hidden pattern of the women's status advancement; second, to explain its qualitative change; and third, to look into the process of transformation. All arguments were conducted from a complexity perspective, with inter-discipline nature and holism assumption, different from the most previous studies with reductionism assumption. In addition, the geometrical oriented method “phase portrait” was employed to visualize the research outcomes, which is the relative new attempt to this research area.

## THEORY AND HYPOTHESES

### Women's Status in Workplace

Scholars suggested numerous theories or perspectives to explore the factors which influence women's status in workplace; however, it is hard to differentiate them exclusively. For capturing the essentials, the previous studies are classified to three categories: personal and family, organization, and environment (Eby, *et al.*, 2005; Van Daalen, *et al.*, 2006). Within each of them, several factors are included (as Table 1).

Table 1: Studies Related to Women's Status in Workplace

| No | Category            | Factor  | Major Theory/Perspective/Model  |
|----|---------------------|---|---|
| 1  | Personal/<br>Family | <ul style="list-style-type: none"> <li>▪ Biological</li> <li>▪ Psychological</li> <li>▪ Capability</li> <li>▪ Family</li> </ul> | <ul style="list-style-type: none"> <li>▪ Biological decision perspective</li> <li>▪ Psycho-analysis theory/Gender role theory</li> <li>▪ Human capital theory</li> <li>▪ Life cycle theory/Family constraint theory/ Family resource perspective/Family economy model</li> </ul>  |
| 2  | Organization        | <ul style="list-style-type: none"> <li>▪ Performance</li> <li>▪ Structure</li> </ul>  | <ul style="list-style-type: none"> <li>▪ Statistic discrimination theory/Over crowding theory</li> <li>▪ Internal labor market theory/Labor market discrimination theory/Gender segregation perspective</li> </ul>  |
| 3  | Environment         | <ul style="list-style-type: none"> <li>▪ Economic</li> <li>▪ Social culture</li> <li>▪ Politic</li> <li>▪ Technical</li> </ul>  | <ul style="list-style-type: none"> <li>▪ Dual economy theory/Dual labor market theory/Opportunity structure perspective/Female marginalization theory</li> <li>▪ Social discrimination theory/Social normative structural perspective</li> <li>▪ Radical feminism</li> <li>▪ Technological development perspective</li> </ul> |

### Summary and Limitation of Women Literatures

Researchers had devoted much effort on women status in workplace: on the theory establishment, over thirty theories or perspectives generated from various disciplines as the previous review; on the level of analysis, micro level and macro level were presented as the impact factor and the developmental trend, respectively. The former included personal, education, family, marriage and caring, organization, social culture, economic and technology (Browne, 1998; Reavley, 1993). Their relationships with workplace women's status were commonly expressed as  $Y=f(X_1, X_2, X_3, \dots, \epsilon)$ , with linear assumptions behind; and the latter consisted of salary level, labor participate rate, and women labor participate type (Bowen, 2003; Gullason, 1999). They were mostly viewed as index of the overall trend of women's status development and were analyzed through the trend figures, such as the S curve.

Numerous outcomes are accumulated; however, few limitations are still need for further exploration. For example, the linear assumptions behind the previous studies ignored the nonlinear interaction among social members in the real world. Up and down fluctuation of women's status should not be neglected. Second, the previous studies depicted trend figure by connecting the static points between certain intervals, which showed only quantitative, but little qualitative information on the advancement of workplace women's status. Third, the previous studies often focused on the sole indicator, to observe its trace and to explain the causes to the turning points, however, what did it mean if two indicators were different is lack of sufficient explanation.

All above need a rich theoretical explanation to provide the deeper insights. This study, therefore, attempted to bridge the knowledge gaps through the complexity perspective. In the next section, the origins of complexity science was described first, and then discussed why study complexity theories in social science, followed by the introduction to sub-theories and core concepts of complexity, and finally developed theoretical framework and hypotheses of this study.

### Complexity Perspective

In the 17<sup>th</sup> century, after Newton found Law of motion, the Universe was considered following the certain physical laws named the first science revolution. However, nature of most events in real world is not linear. Thus, the suggestion of relativity in 1905 and quantum mechanics in 1925 resulted in the second science revolution. Above are called "Being Physics" which concerned the change in quantity, not in quality. The lack of evolution consideration was later filled by "Becoming Physics" which bringing the science to the third revolution. Since 1960s, new theories related to self organization and evolution gradually appeared (Lorenz, 1963; Thom, 1975; Prigogine & Stengers, 1984) such as dissipative structure, catastrophe, chaos, synergetics and fractal theories. In the past twenty years, the complexity family theories were applied to the various social science fields, parts of scholars called it as "paradigm shift" of social science, from Newtonian worldview to complexity worldview. The former emphasized reductionism, linear causal-effect, static equilibrium and system equals to the sum of the parts, whereas the latter emphasized holism, nonlinear causal-effect, dynamic equilibrium and system is larger than the sum of the parts. The systematic thinking attracted lots of scientists doing integrated researches cross traditional disciplines.

Why adopt complexity perspective on workplace women's status in this study? Mathews, White, and Long (1999) considered that the application of complexity theories, originally from natural science, increased the face validity of social science. They suggested five reasons: the increasing change rates of social phenomenon, the increasing emphasis on process research in social science, models in complexity theories similar to existing social behaviors, poor analytical results from analyzing dynamic systems with standard statistical techniques, and finally, the meta-theoretical and philosophical implications: the assumption of Newtonian worldview was considered to provide only a partial view of "reality", whereas the complexity worldview could be the supplement perspective.

Two members of complexity theory family, dissipative structure theory and catastrophe theory, were briefly described as below. Dissipative structure theory was proposed by Prigogine in 1969. It focused on how an open system forms a new stable order structure in far-equilibrium nonlinear areas. Harvey and Reed (1996) concluded four conditions to form and maintain dissipative structure. First, it is an open system to exchange energy (or entropy) with environment. Second, a system should keep far from equilibrium which is the source of order; then it is possible for a system transforming to a new order structure through self-organizing. Third, minor fluctuations should exist among agents. Random fluctuation is internal force for system transformation or quality change, that is, order through fluctuation. Forth, agents within a system should interact with each other nonlinearly, it enable system sensitive to the initial value. The destructive force in equilibrium system is conversely viewed as constructive force in dissipative structure. Dissipative structure theory discovered self-organizing processes of system from equilibrium to far-equilibrium, and the transformation mechanism between order and disorder. These phenomenon are commonly existed in natural and human societies, therefore, it has been applied extensively in various disciplines. It also served as a solid basis for bridging natural science and social science and inspiring new directions for traditional studies. This study presented as an example.

Catastrophe theory was proposed by Thom in 1972. Catastrophe theory attempts to mathematically describe discontinuous system behaviors resulting from continuous stimuli (Gregory-Allen & Henderson, 1991). There are two paths of changes existed in the reality. The first is continuous, incremental or quantitative change; the second is discontinuous, radical or qualitative change. Those nonlinear systems with catastrophe phenomenon are relatively stable at most of the time, only reaching the certain critical point the abrupt change occurs. Although the basis of catastrophe theory originated from mathematics, it is not only quantitative, but also qualitative theory. It emphasizes the internal mechanism and the process of a continuous change of control variables leading to an abrupt change of system state, which are closely connected with order and disorder of systems. Catastrophe theory presented a new style of language, such as control variables (usually binary), strange attractor, criticality, divergence effect, reversal effect, cusp catastrophe etc., which are especially appropriate to describe the imprecise social sciences.

To sum up, dissipative structure theory discovered micro-level self-organizing mechanism and the macro-level transformation process between order and disorder of systems, and catastrophe theory also emphasizes the macro-level transformative process of connecting order and disorder of systems. This certain format of transformative process between order-disorder states is called as *pattern* (Figure 1). That is, the pattern of the dissipative structure transformation at the macro level is emerging from self-organizing of agent's interaction at the micro level.

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Insert Figure 1 Here  
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### Theoretical Framework and Hypotheses

This section applied the core concepts of complexity theories to the advancement of workplace women's status, and depicted the pattern of the system transformation from micro and macro aspects. At the micro level, the analogy between dissipative structure and working women collective structure was explained first, and served as the theoretical framework of this study. Then the hypotheses, at the macro level, were further developed based on this framework.

As applying complexity concepts to a social system, which is conceived as a dissipative structure (Harvey & Reed, 1996). It is a far-from-equilibrium open system: agents interact with each other (or self-organizing) within system and exchange information and energy with external environment, for evolving and adapting to environment change. Fluctuation is the internal condition for system evolution to reach qualitative change. Generally speaking, random fluctuation always existed within system, of that, complicated interaction occurred among agents. However, it would not ultimately affect system state unless the system was influenced by external heavily forces constantly, which lead the system to an unstable status. Under that, any minor random fluctuation is possible to be magnified, and cause system transformed to a new stable state.

Here, dissipative structure refers to working women collective structure. Internally, individual woman interact with each other within societies, and externally, women collective structure exchange information with economic, politic, social, cultural and technological environments. Forces facilitating working women's status improvement are called *positive feedback* (or increasing return), such as higher human capital and labor participation. On the contrary, forces impeding working women's status improvement are called *negative feedback* (or decreasing return), such as family constrains and social discrimination. Two opposite forces generate up and down phenomenon of women's status. As external heavy forces, the development of economy and society, constantly influenced working women's status and pushed the important parameters reach the critical value, the qualitative change occurred. After that, the fluctuation become more stable, and the status of working women reaches a new level eventually.

The more details of internal and external processes are described as follows. Internally, the overall phenomenon is emerging from self-organizing, consists of the

agents' decision rule and agent-agent interaction processes (Ormerod, 2000). The former refers to "feedback loop", that is, when an agent makes the certain decision and results in the positive consequences, which reinforces the agent to repeat that decision, which is called positive feedback. Otherwise, it decreases the possibility of repetition, which is called negative feedback. For instance, in the paternal society, competition and corporation both exist among men and women, when women obtained higher status from making certain decisions or performing some behaviors; it is more likely for women to adopt the same approaches, otherwise not. The latter refers to "institution effect", that is, the agent's behaviors are influenced by other members in the system. The larger ratio of the certain behaviors performed, the more members mimic those behaviors. For instance, the ratio of female manager in the initial phase has impact on that in the following phases. The pioneer female managers serve as models for followers to imitate. It leads to more high-position working women and better acceptance by society. On the contrary, the lower ratio of women manager at the beginning phase leads to lower ratio in the later phase, and the acceptance from society is also relatively low. Therefore, whether women participate labor market or pursue management position depends on their optimal decision and the effects from the surroundings. Externally, women interact with economic, political, social culture and technological environments, which stimulate women status constantly. Discrimination from organization processes, lack of social supporting policies, and depression from traditional value and gender stereotypes all contribute to the oppression of women status. On the contrary, economy growth, industry transformation, demographic structure change and technical development demonstrate positive forces to improve women's status. In sum, both internal interactions among individuals and external interactions with environment contribute to the fluctuation, even the quality change of the women's status.

**Hypothesis 1.** Catastrophe theory suggested that discontinuous system behaviors resulting from continuous stimuli. In which, "self-organized criticality" was used to explain that importing energy into system stably facilitates the component of the system constantly interact with each other, and evolves the system to the critical state. Under that state, a small change may result in chain reactions, once the energy accumulates to certain degree and reaches the critical value; it leads the system to the immense transformation, becoming the different state. The new state, resulting from the impact of both external condition and internal interaction, performs different behaviors at macro level from the previous state.

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In this study, self-organized criticality is drawn to explain the quantity change of working women's status (Figure 2). Continuous stimuli refer to internal and external factors which influence the women's status, and discontinuous system states refer to the old and new women's status in workplace. In the old times (State A), women's status in workplace was relatively low and the degree of individual difference among their background is quiet high. Internal self-organizing force comes from self-adjustment of individual woman or their interactions with other members in societies (feedback loop and institution effect), whereas the external importing energy comes from environments such as economic or social forces, which discussed much above. However, in the present (State C), their status in workplace increase and the variance among them decrease. System then evolves to the critical state, under that, once the energy reach the critical value, women's status in workplace change qualitatively. Therefore, hypothesis one was developed as follow:

*Hypothesis 1: The working women's status in the present differs from that in the old times qualitatively.*

*Hypothesis 1a: The centrality level of working women's status in the present differs from that in the old times.*

*Hypothesis 1b: The deviation degree of working women's status in the present differs from that in the old times.*

**Hypothesis 2.** Dissipative structure theory suggested that "feedback" refers to the output of a system as the input of that system in the following phase. There are two opposite directions: one is positive feedback, or increasing return, it magnifies minor disturbances and reinforces the system deviating from the original state to the irreversible state; the other one is negative feedback, or decreasing return, it stabilizes minor disturbances, keeps the system staying on the stable state and prevents it from disorder. Generally, both feedbacks always co-exist in a nonlinear system, they complement each other. With only positive feedback leads a system to the chaos state; on contrary, with only negative feedback inhibits a system for further evolution. When two kinds of feedback exist together, a system could evolve stable and destruct creatively at the same time.

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In this study, nonlinear feedback is drawn to explain the transition process (State B) of working women's status (Figure 3). Positive feedback refers to the force which improves working women's status, such as economic one, and negative feedback refers to the force which impedes working women's status, such as social culture. Take economic and social forces as examples for illustrating the effect of positive and negative feedback on the different growth traces of female employees and managers. Economic force magnifies minor disturbances and reinforces working women's status deviating from the old times; and the social culture force stabilizes minor disturbances and keeps working women's status staying on the stable state and prevents it for evolution. Economic force magnifies the status of both female employees and female managers; however, social culture force has different degree of impact on female employees and female managers. For female employees, working for better family finance fits women's traditional assistant role; however, for female managers, being a manager counters "men are superior to women" value in the Eastern cultures, so the negative force is larger on female managers than that on female employees. Thus, when two forces operate together, the growth speed of female worker and female manager is different. Therefore, hypothesis two was developed as follow:

*Hypothesis 2: During the transformation process from the old times to the present, the growth slope of female worker and female manager is different.*

## METHODS

### Sample and Data Sources

This study used the secondary longitudinal data. The sample is above 15 year-old domestic labors in Taiwan. The data source, Human Resource Survey and Economic Statistics, was released monthly by Directorate-General of Budget, Accounting & Statistics, Executive Yuan, R.O.C. ranging from 1978 to 2003. Human Resource Survey used random sampling method to select sixty thousands people per month, around 0.3% population of Taiwan, and collected data following formal personal and telephone interview procedures.

### Measures

Stroup (1997) suggested that measurement of dynamic system should include longitudinal data, that is, time series data, and contextual variables. The former, index of workplace women's status, was selected based on gender empowerment measurement (by UNDP), the state of women in the world atlas and female economic capability statistics, such as female employment rate and female manager rate; while the latter, economic variables, included economic growth rate, unemployment rate and gross domestic product (GDP) by industries, which is highly related to the quality change of industries (Bergen, 1991). Definition of each measure is as below.

**Female manager rate.** The definition of manager is adopted from the standard of occupational classification. Of that; female manager rate refers to women as a proportion of all managers.

**Female employment rate.** Generally, supply of female labor is measured by female labor participation rate. However, for comparing with female manager rate, female employment rate is defined as women as a proportion of all waged workers.

**Economic growth rate.** The yearly increasing percentage of gross domestic product.

**Unemployment rate.** The percentage of unemployment workers of all workers.

**Gross domestic product by industries.** The total product in domestic areas by agricultural, industrial and service sectors.

#### Analytical Techniques

Phase portrait or return map is a geometrical technique, mostly appeared in chaotic studies (Stroup, 1997). It visualizes time series data of dynamic system in an abstract mathematical space for capturing the change of system state through graphics and related characteristics (Goldstein, 1996). Long-run rhythms and short-term variability of system could be observed (Berry & Kim, 1996). The former is learned from the change of attractor location: when points apparently focused at different areas with different degree of deviation over time, the system experiences a catastrophic switch, or a qualitative change. The later is obtained from the limited distribution of points representing the fluctuation of system: their locations are uncertain but always appear in a stable limit cycle, which is also called Poincare oscillators (Glass & Mackey, 1988).

### RESULTS AND DISCUSSION

In this section, pattern of workplace women's status advancement was identified first, then four phases of Taiwan economic development in past decades was used as the context for demonstrating the system evolution, including the states before and after change, and its mid-transition process.

#### Pattern of Workplace Women's Status Advancement

In this study, working women's status was viewed as a dissipative structure system. It magnified fluctuation through positive feedback and adapted to changing environment, furthermore, crossed the critical point and reached the new dynamic equilibrium, which followed order-disorder-order (as Figure 1). The time series of female employment rate (Figure 4) and female manager rate (Figure 5) from 1978 to 2003 showed the same pattern as Figure 1: the system originally exists at the old state (A), experiences a chaotic transformation (B), and finally, reaches the new state (C).

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For further exactly defining the interval of each state of women's status, the context structure needs to be set up first. Workforce change was connected to economic environment. This section demonstrated Taiwan economic development in past decades and classified the period into four phases.

Colin Clark (1983) grouped industries into primary, secondary and tertiary and considered any economic body mixed by three sectors. Influenced by the industrialization, workforce was transferred from agricultural to manufacturing, then service industry, or from extractive to fabricating, then processing, which is also called knowledge economy. The change of industry structure in Taiwan also followed Colin Clark's model.

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Four economic developmental phases was identified by considering GDP by industries, economic growth rate, and unemployment rate together (as Figure 6 to Figure 9). The first phase (1978-1981): after 1960s, manufacturing replaced agricultural as domain industry and it was slightly more than service industry; the second phase (1981-1987): service was slightly more than manufacturing from percentage point of view; however, GDP showed that both increased slightly over time. It seemed that both were competitive, however, manufacturing was almost up to the limit, while service industry started to boom up; the third phase (1987-1998): service industry took over the role of manufacturing and became the main industry; the fourth phase (1998-2003): the gap between service and manufacturing increased, however, for depression reasons, service industry maintain slowly growth.

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In Figure 10, the data of female employees and female managers of Taiwan fit into the economic structure and generated eight phases, including female employment rate (E1 to E4) and female manager rate (M1 to M4). In E1, after 1960s, industrialization caused the lack of labor, higher wage increased opportunity cost for women staying at home, so women employment maintained at a stable level; in M1, natural science training requirements was not the strength of women, it was more difficult for them to be promoted and FM remained relatively low; in E2, service industry gradually replaced manufacturing, which released great amounts of jobs for women; in M2, for not accumulating enough work experience and network being a manager, FM had have not grown significantly; in E3, service was as domain industry, FE grew stably over time; in M3, the needs of service industry, such as flexibility and interpersonal orientation, matched with women's nature and more experiences they owned, FM increased mostly in this phase; in E4, economic depression lead to more working women for family economic needs; in M4, the same reason cause businesses downsizing, FM increased slowly.

In terms of system evolution, for female employees, the old state (A) referred to E1, the transition state (B) referred to E2, and the new state (C) referred to E3 and E4; while for female managers, they are M1 & M2, M3, M4, respectively. Change between states (A and C) and transition process (B) were discussed further as follows.

#### Qualitative Change of Women's Status in Workplace

Figure 11 and 12 showed two distinct *centralities* of female employment rate and female manager rate from 1978 to 2003, they are 33%, 39% as centers for FE, and 6.5%, 12.5% for FM, respectively. In addition, the *deviation* of female employees in old state (Figure 13) is larger than that of in the new state (Figure 15) and the female managers as well (Figure 14 & Figure 16). Therefore, H1a and H1b are both supported.

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Female employees and female managers occupy the different positions in workplaces; however, they experience the similar processes. In the old times, family was generally women's first priority, employers and government officials viewed women's role as supplement manpower. Such tradition was reinforced through various kinds of socialization. For female employees, family played the key role in the old times. Working outside is mostly for financial or other non-personal reasons. Their labor participation rate is relatively low and the degree of individual difference in background is high. For female managers, social acceptance is even lower than female employees in the old times, since manager is often the symbol of authority, which is not fit to the traditional image of women. The greater individual differences also exist among women. Thus, female manager ratio is quiet low and the variance among them is high.

However, in the present, due to the service industry's growth, technology development, extensive education and social cultural change, especially the knowledge-based economy that provided better chances for women, they involved in work more actively. For female employees, higher education level, higher self-awareness, more job opportunities and higher social acceptance increase women's labor participation rate and decrease the variance among them. For female managers, job demand of labor market changes, knowledge-based work is more gender-free, and the society gradually accepts that women's achievement is not only from their family. Thus, the more female managers appear in various occupations and the less variance among women. In sum, the importance of female human resources in the present is significantly higher than that in old times; the status of workplace women is different qualitatively.

#### **Transition Process of Women's Status in Workplace**

Figure 10 showed the *growth slope* of female employee (E2) is larger than that of female manager (M3) during the transformation process from the old times to the present. Therefore, H2 is supported.

Both growth speeds were reinforced by positive forces and inhibited by negative forces. Economic and social forces played critical roles during the transition period of workplace women's status. Female employee ratio and female manager ratio demonstrate increasing trend because of economic transformation and social openness. Economic forces bring more job opportunities which are more knowledge and service-oriented, and it benefit to women career development. On the other hand, social culture diversity decelerates the negative forces, but the impact on female employees and female managers is different.

For female employees, the development of service industry provided many job opportunities, and they attended labor market for extra income which matched the women's assistant image in traditional culture. For female managers, though economic force also brought better advancement, however, being female managers, whose image is opposite to traditional stereotype "men are superior to women", women are expected to choose family once the conflict occurred between work and family, thus they received less supported than only being non-manager workers. In short, positive and negative forces shaped the different growth traces between these two groups.

### **CONCLUSION**

There are rich findings of workplace women's status from general perspective in the past studies, which adopted reductionism and mostly focused on the impact factors and trend of its development. However, complexity perspective adopted holism and focused on the interaction among agents and their nonlinear relationships, which provided more insights on the hidden pattern of workplace women's status.

At least three potential contributions are presented in this study. First, the new methodological assumption shed the light on the questions which general perspective was not capable to explain; second, this study enhanced generalization of complexity theories from physical and biological to social systems; and third, the geometrical oriented "phase portrait or return maps" was used to visualize the hidden pattern of system evolution, which is the relative new attempts in social science research.

The implications for research include theoretical and methodological. For better theoretical validity, scholars established various theories to "correctly" explain, predict and control the research subjects, but could this be a big problem itself? Complexity science questioned reductionism and linear causality and suggested that more realistic theories should be developed; it emphasized holism and nonlinear causality to comprehend the phenomenon of the real world. First, the interaction among individuals should be taken into account; some characteristics usually emerged at macro level, which could not be seen at micro level. That is, the black box could be better understood through self-organizing mechanism. Second, complexity science argued that short-term prediction is difficult, but long-term prediction is possible because of the pattern-based causality, which is presented by the density and repetition of attractors (or probability) in graphics. On the other hand, for diversity method avocation, more and more researchers noticed the importance of cross-discipline exchange. In addition, computer software development encouraged scholars to adopt multi-methods for further breakthrough.

There are few suggestions for future research direction. First, other sub-theories in complexity family such as fractal or synergetic could be applied to explore the characteristics of self-similarity or co-evolution of workplace women's status development. Second, other methods, such as agent-based modeling, cellular automata, neural networks and genetic algorithms, could be employed for further analysis. Third, index selection could include women's share of professional positions or average GDP of women. Fourth, samples could extend to other similar or different economic or cultural societies to examine if the pattern did exist across populations. Fifth, sample could also be divided to different industries or occupations to examine the pattern existence. Sixth, repetition analysis could be conducted ten years later or longer to identify the pattern from the old state to the new state. All above are expected to extend the usefulness of complexity perspective in social science research.

### **REFERENCES**

- Acker, J. (1991), Hierarchies, jobs, bodies: A theory of gender organization, 162-179, in Lorber J. & Farrell S. A. (Eds.) *Social Construction of Gender*. Newbury: Sage
- Averitt, R. T. (1966), *The dual economy*, New York: Norton
- Becker, G. S. (1975), *Human Capital*. 2<sup>nd</sup> ed. Chicago: the University of Chicago Press.
- Bergen, E. (1991), The economic context of labor allocation: Implications for gender stratification. *Journal of Family Issues*, 12, 2: 140-157
- Bergmann, B. R. (1974), Occupational segregation, wages and profits when employers discriminate by race and sex, *Eastern Economic Journal*, 1:103-110
- Berry, J. L. & Kim, H. (1996), Long waves 1790-1990: intermittency, chaos, and control, In Kiel, L. D & Elliott, E. (Eds.), *Chaos theory in the social sciences: Foundations and Applications* (pp. 215-236). Ann Arbor: The University of Michigan Press.
- Brown, C. C. (2003), Sex discrimination in selection and compensation in Taiwan, *International Journal of Human Resource Management*, 14, 2: 297-315
- Browne, K. R. (1998), An evolutionary account of women's workplace status, *Managerial and Decision Economics*, 18, 7: 427-440
- Clark, C. (1983), *The conditions of economic progress*, Garland Publishing.
- Doeringer, P. B., & Piore, M. J. (1971), *Internal labor markets and manpower analysis*. Toronto: D. C. Heath
- Drucker, P. (1994), The theory of the business. *Harvard Business Review*, Sept-Oct: 55-104

- Eby, L.T.; Casper, W.J.; Lockwood, A.; Bordeaux, C.; Brinley, A. (2005), Work and family research in IO/OB: Content analysis and review of the literature (1980-2002), *Journal of Vocational Behavior*, 66, 1: 124-197
- Faulkner, W. and Arnold, E. (Eds) (1985), *Smothered by Invention*, London: Pluto Press.
- Fisher, H. (1999), *The first sex: The natural talents of women and how they are changing the world*, New York: Random House, Inc.
- Glass, L. & Mackey, M. C. (1988), Steady states, oscillations, and chaos in physiological systems, *From clocks to chaos: the rhythms of life*, Princeton University Press, 19-35
- Goldstein, J., (1996), Causality and emergence in chaos and complexity theories. In Sulis, W. and Combs, A. (Eds.) *Nonlinear dynamics in human behavior*. World Scientific: 161-190
- Greenstein, T. (1989), Human capital, marital and birth timing, and the postnatal labor force participation of married women, *Journal of Family Issues*, 10(3): 359-382
- Gregory-Allen, R. B., & Henderson, G. V. (1991) A brief review of catastrophe theory and a test in a corporate failure context. *The Financial Review*, 26, 2: 127-155
- Grusky D.B (1998), The past, present and future of sex segregation methodology, *Demography*, 35, 3: 497-504
- Gullason, E. T. (1999), The labor market status of women, *Cato Journal*, 19, 1: 101-118
- Harvey, D. L. & Reed, M (1996), Social science as the study of complex systems. In Kiel, L. D & Elliott, E. (Eds.), *Chaos theory in the social sciences: Foundations and Applications* (pp. 295-323). Ann Arbor: The University of Michigan Press.
- Horner, M. S. (1972), Toward an understanding of achievement-related conflicts in women, *Journal of Social Issues*, 28: 157-173
- House, J. (1981), *Work stress and social support*. California: Addison-Wesley Publishing
- Jacobsen, J.P. (1994), *The economics of gender*. Wesleyan University, pp. 229-230
- Kanter, R. (1977), *Men and women in the corporation*. New York: Basic Books
- Lenski, G., Lenski, J. & Nolan, P. (1992), *Human societies: an introduction to Macrosociology*, Mcgraw-Hill College.
- Lorenz, E. (1963), Deterministic nonperiodic flow. *Journal of the Atmospheric Science*, 20:130-141
- Mason, K. O., Czajda, J., & Arber, S. (1976), Change in U. S. women's sex-role attitudes, 1964-1974. *American Sociology Review*, 41: 573-596
- Mathews, White, and Long (1999), The problem of prediction and control in theoretical diversity and the promise of the complexity sciences, *Journal of Management Inquiry*, 8, 1: 17-31
- Mead, M (1935), *Sex and temperament in three primitive societies*. NY: William Morrow.
- Nieva, V. F., & Gutek, B. A. (1981), *Women and work: A psychological perspective*. New York: Praeger Publishers
- Ormerod, P. (1998), *Butterfly Economics: a new general theory of social and economic behaviour*, Faber and Faber.
- Phelps, E. S. (1972), The statistical theory of racism and sexism, *American Economic Review*, 62: 4659-4661
- Prigogine, I & Stengers, I, (1984), *Order out of chaos: Men's new dialogue with nature*, New York: Bantam Books
- Reavley, M. A. (1993a), The employment status of women in Canada: A general overview and description of theoretical approaches used to study this phenomenon, *Equal Opportunities International*, 12: 1-6
- Ridgeway, C. L. (1996), Interaction and the conservation of gender inequality: considering employment, *American Sociological Review*, 62:218-235
- Saffioti, H. (1978) *Work in class society*, New York: Monthly Review Press.
- Schmid, G. (1984), *Sex discrimination and equal opportunity: The labor market and employment policy*, Palgrave Macmillan
- Susan Moller Okin (1989), *Justice, Gender, and the Family*, New York: Basic Books
- Stroup, W. F. II (1997), Webs of chaos: Implications for research designs. In Eve, R. A., Horsfall, S. & Lee, M. E. (Eds.), *Chaos, complexity, and sociology* (pp125-140). Thousand Oaks, CA: Sage.
- Thom, R. (1975) *Structural stability and morphogenesis: an outline of a general theory of models*. Reading, MA: W. A. Benjamin
- Tomaskovic-Devey, D. (1993), The gender and race composition of jobs and the male/female, white/black pay gaps, *Social Forces*, 72, 1: 45-76
- Van Daalen, G.; Willemsen, T.M.; Sanders, K. (2006), Reducing work-family conflict through different sources of social support, *Journal of Vocational Behavior*, 69, 3: 462-476
- Waite, L. J., (1980), Working wives and the family life cycle. *American Journal of Sociology*, 88, 2: 272-294
- Zeller, H. (1975), The determinants of occupational segregation, In Cynthia Lloyd (Eds.), *Sex, discrimination, and the division of labor*, New York: Columbia University Press

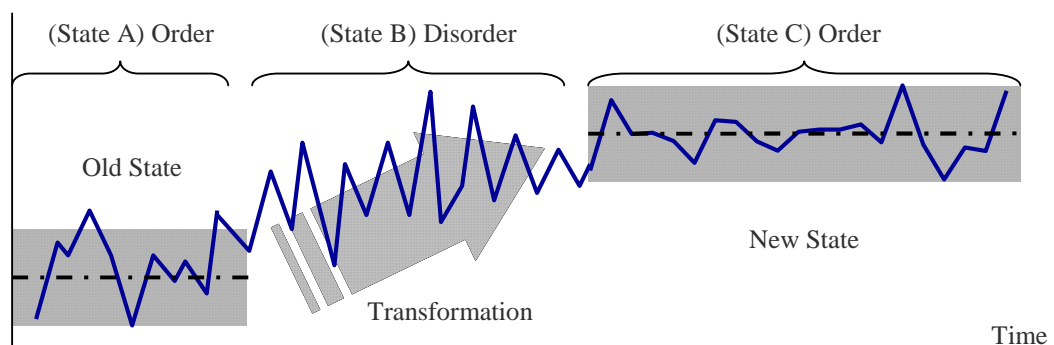


Figure 1: Pattern of the dissipative structure transformation

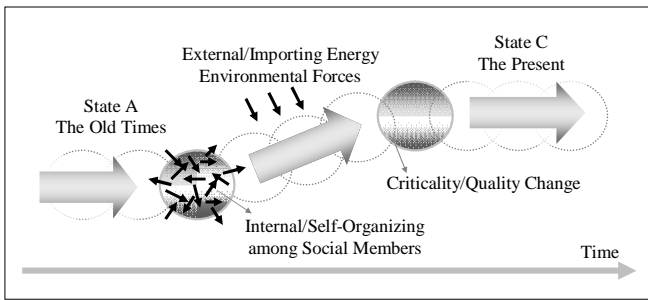


Figure 2: Qualitative Change of Women's Status in Workplace

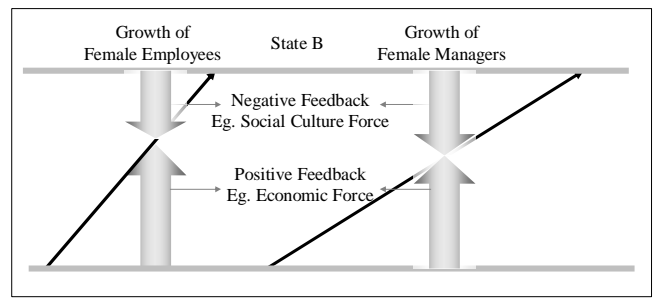


Figure 3: Transition Process of Women's Status in Workplace

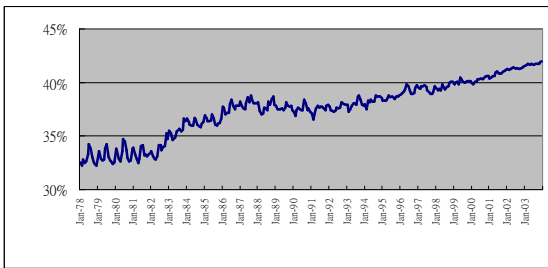


Figure 4: Female employment rate (1978-2003)

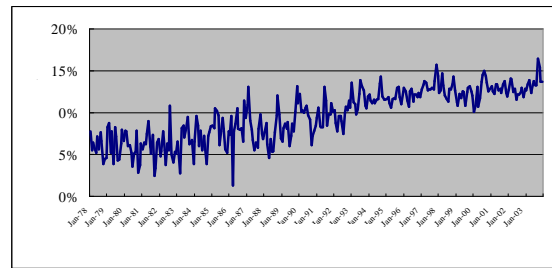


Figure 5: Female manager rate (1978-2003)

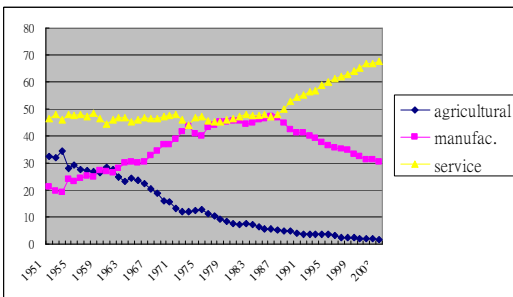


Figure 6: GDP by industries, % (1951-2003)

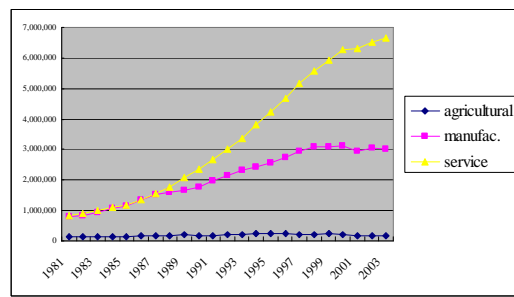


Figure 7: GDP by industries, NTD (1981-2003)

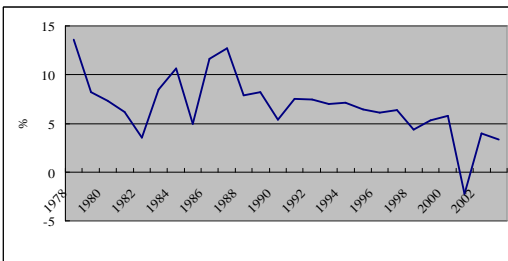


Figure 8: Economic growth rate (1978-2003)

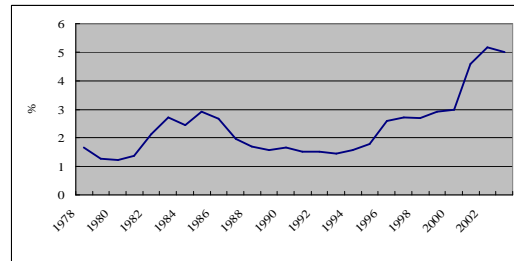


Figure 9: Unemployment rate (1978-2003)

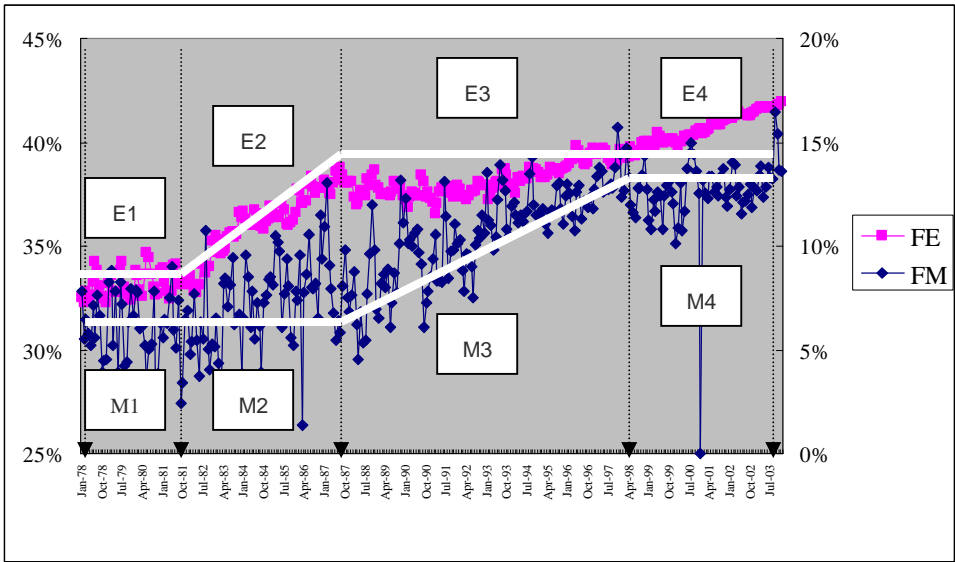


Figure 10: Pattern of workplace women's status change in Taiwan

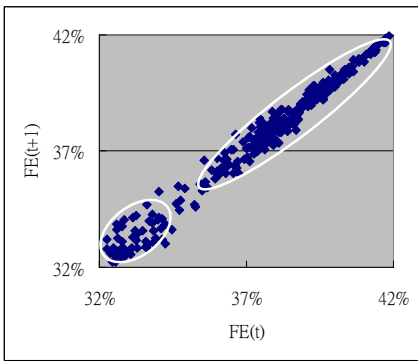


Figure 11: Phase portrait of female employee rate (1978-2003)

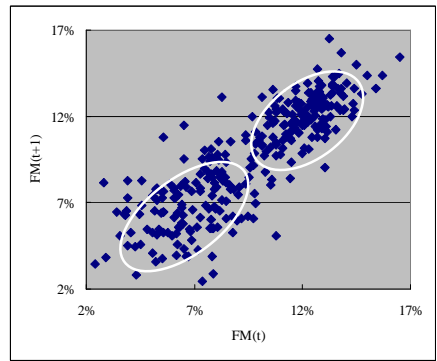


Figure 12: Phase portrait of female manager rate (1978-2003)

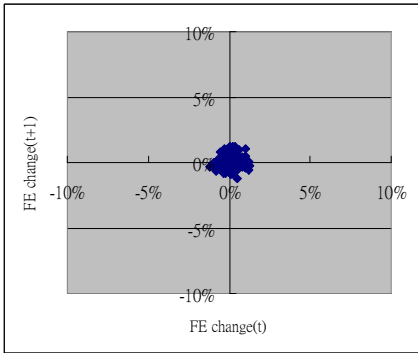


Figure 13: Phase portrait of female employee annual change rate (A, 1978-1981)

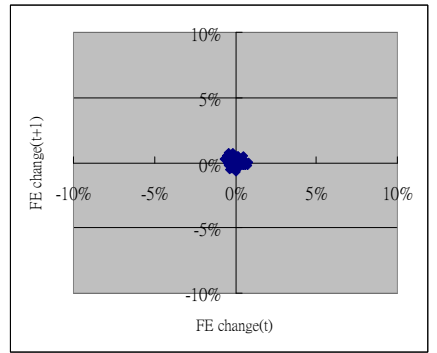


Figure 14: Phase portrait of female employee annual change rate (C, 1987-2003)

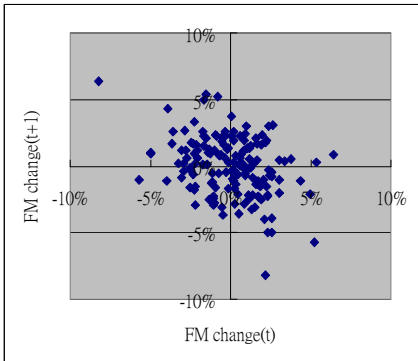


Figure 15: Phase portrait of female manager annual change rate (A, 1978-1987)

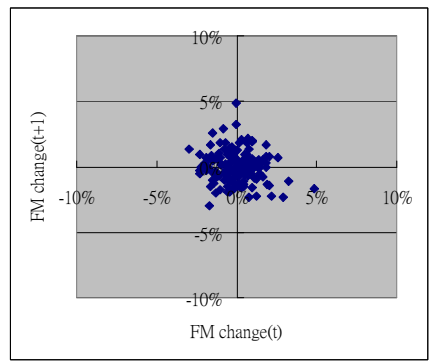


Figure 16: Phase portrait of female manager annual change rate (C, 1998-2003)