Research on Measuring Human Capital Factors – An Example Using Household Sewing Machine Industry in Taiwan

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Abstract

Taiwan, one of the largest exporters of household sewing machines in the world, has witnessed a sharp decrease in export volume since a majority of manufacturers moved their production to China in 2000. This research focuses on the evaluation factors for human capital in the household sewing machine industry in Taiwan. This research combines human capital theories specifically in terms of evaluation factors, and attempts to analyze the household sewing machine industry in Taiwan in terms of leadership capability, talent management, innovation, and capabilities related information. The findings of this research include 1) confirmation of the measurement variables; 2) that the interviewees do not value the human resource management system; 3) that, in terms of capabilities related to information, interviewee sex, age, position, and education are not relevant to the employees' capacity; and 4) that the interviewees' education level is not relevant to those measuring variable.

Key words: Human Capital Factors, Household Sewing Machine Industry, Human Resource Management System

INTRODUCTION

Taiwan was a leading exporter of sewing machines in the 1970s, with an annual export volume of 3,160,000 providing 50% of the total world output. Since 2000, Taiwan's export of sewing machines has continuously dropped. The previous world leader in this industry (which is comprised of many world-class sewing machine manufactures) was forced to relocate from Taiwan to China, Vietnam and other similar locations in order to lower manufacturing costs. However, Taiwan was unable to rapidly improve product quality, enhance its own competitiveness and develop related technologies. As a result, China has successfully replaced Taiwan as the leader in this industry.

With this major shift in the industry, Taiwanese sewing machine companies have transformed themselves from purely manufacturing-oriented enterprises to firms that run operations related to global distributed manufacturing, sales and marketing. Because of this dramatic change, effective resource allocation and training have played a critical role at many Taiwanese sewing machine companies. Therefore, research on the impact of human capital management on the household sewing machine industry in Taiwan is both interesting and important.

Typically, household sewing machines are classified into three categories based on selling price including high selling price, fair selling price and low selling price. The Taiwanese household sewing machine industry focuses primarily on manufacturing low selling price household sewing machines. The majorities of the above sewing machine firms typically lack R&D (research and development) capabilities, operate on a much smaller scale, and do not have their own patent and brand. The aforementioned facts lead to that Taiwanese household sewing machine firms fail to develop new technologies and products which can penetrate the high-end markets. The entire sewing machine industry in Taiwan has been constantly frustrated and challenged by these critical issues as it seeks to reinforce its ability to develop high selling price products, enhance manufacturing technologies, and confront difficulties in training multi-national managers. Therefore, this research pinpoints the critical importance of effectively leveraging human capital to transform the business of household sewing machine companies. Currently, research on human capital primarily focuses on high technology or financial services industries, with very little emphasis on the sewing machine industry.

This research involves membering companies of the Taiwanese Sewing Machine Export Association and employs questionnaires to achieve the following objectives:

1 To establish applicable human capital measurement indicators for the Taiwanese sewing machine industry.
2 To understand the point of view of the Taiwanese sewing machine industry with regard to human capital.
3 To help the Taiwanese sewing machine industry understand how to leverage human capital more effectively; in addition, to contribute to human capital management in the Taiwanese sewing machine industry and provide relevant suggestions.

LITERATURE REVIEW

Human capital has received significant attention in the popular press and academic human capital literature. The concept of human capital originated from Schultz's "Investment in Human Capital", published in the American Economic Review in 1961. Schultz (1961), the first author use the term "human capital" in modern economic literature, classifies expenditure on human capital as investment that involved technology, experience, and knowledge. In 1964, Becker's book formally recognized the significance of human capital as a dedicated research subject. Becker (1964) thought that investments in human capital improve human resources and monetary income and consumption. He also pointed out that organizations could manage and invest in human resource in order to further extend such human capital, recognizing the higher potential of employee contributions. Such investment in human capital was thought to result in higher employee productivity and organizational performance.

Schultz (1971), the Nobel winner and economist, introduced the concept of human capital in 1971. He thought that human resources was one of the foremost firm resources and that education and training were the main components of human resource investment based on analyses of a large quantity of case studies. Schultz also assisted that the achievements of education and training represented the benefits from human capital. Since 1999, the US federal government has started to replace human resources with human capital. With the arrival of the knowledge economy, the renewed understanding of human capital has produced a significant positive impact (Leonard-Barton 1995；Sveiby 1997).

Human capital is an intangible resource and has been viewed and defined by researchers and organizations in a number of ways. Human capital can be defined as skills and expertise, problem-solving ability, knowledge, leadership styles and abilities and everything that is embodied in employees (Brooking 1996; Dzinkowski 2000; Edvinsson and Malone 1999; Knight 1999; Lynn 2000; Roos, Edvinsson and Dragonetti 1998; Stewart 1997). It incorporates knowledge, skills, innovation and each individual employee's ability to handle his/her tasks; it also includes the firm's values, culture, and philosophy. Davenport (1999) finds that human capital consisted of four major components. The first is ability: proficiency in a set of activities or forms of work, including the subcomponents of knowledge, skills and talent. The second is behavior: observable ways of acting that contribute to the accomplishment of a task. The third is efforts: the conscious application of mental and physical resources toward a particular end. The fourth is time: the chronological element of human capital investment, including hours per day, years in a career, or any unit in between.

Dess and Picken (1999) define human capital as deeply embedded in and inseparable from abilities, knowledge, skills or experience. They separate human capital into the categories of action skills, information-gathering skills, information-processing skills, communication skills, experience, knowledge, social skills, and views on values, beliefs and attitudes. Barney (2002) refers to and includes the unification of training, experience, judgment, wisdom, relationships and insights from the company's managers and employees. Nalbantian (2004) puts forth the idea that human capital exists in the two forms: the universal form and the corporate form. Lazear (2009) presents a "skill-weight"

Table 1: A Summary of Measurement Indicators of Human Capital

Author(s)	Indicators
Skandia(1998)	Leadership ; motivation ; empowerment ; Number of employees; employee turnover; employee average tenure; number of managers; number of female managers; average age of employees; training cost per employee; percentage of employee under 40; average training days per year; proportion of employees working in associated companies
Wah & Malone(1999)	Employee productivity; company investment in training; employee education and credentials; professional background and years of work experience
Sveiby(1999)	Number of years in a profession; level of education; training and education costs; grading; age; seniority
Edvinsson & Malone (1999)	Leadership; motivation and empowerment; number of employees; employee turnover rate; number of managers; number of long-term full-time employees; average age of employees; employee familiarity with IT; average number of days spent on training per year; percentage of mangers with a high level of education
Grossman(2000)	Revenue factor; voluntary separation rate; human capital value added; human capital ROI; total compensation revenue percentage; total labor cost revenue percentage; training investment factor; cost per hire; health care costs per employee; turnover costs
Zwell & Ressler (2000)	Basic skill; managerial skills; senior management skills
Ernst & Young(2000)	Strategy execution; the reliability of management; quality of strategy; innovation; ability to attract talent; management experience; quality of executive compensation; knowledge leadership
Stewart(2001)	Average year of service; average education level; percentage with advanced degrees; hiring cost; IT literacy; hours of training; employee satisfaction; employee turnover; innovation ability; new colleague-to colleague relationships spawned; success of employee-suggestion programs; value added/employee
Pablos(2002)	Employee overview; employee shift; education; promise and motivation; training results
Bucknall & Zheng (2006)	Productivity and efficiency; recruiting and employee training; professional achievements and rewards

view on human capital. Under this view, all skills are general and are used with different weights across firms. Hunter et. al. (2010) propose a view that human capital is becoming increasingly important as a factor production.

In summary, human capital can be considered as the company assets including all resources derived from people. In specific, human capital includes: (1) corporate values, culture and philosophy; (2) the characteristics of the management; (3) experiences, professional knowledge and skills owned by all employees; (4) employee's attitude, belief and behavior; (5) any capitals which help foster organizations. In other words, human capital represents the combination of technological accumulation and individual knowledge. Furthermore, human capital refers to the people who possess skills, experience and knowledge and are of economic value to organizations. Therefore, while considering the management and development of human capital, organizations should spare no effort to uncover creativity, professional skills, loyalty and informal interactions between organizational management teams, from their internal employees. It is one of the most important areas for most companies to focus on to realize how to retain talent to accumulate corporate human capital in order to obtain much-needed competitive advantage.

A growing number of studies, organizations and management consulting firms have tried to effectively measure the human capital. This study summarized the measurement indicators of human capital in Table 1.
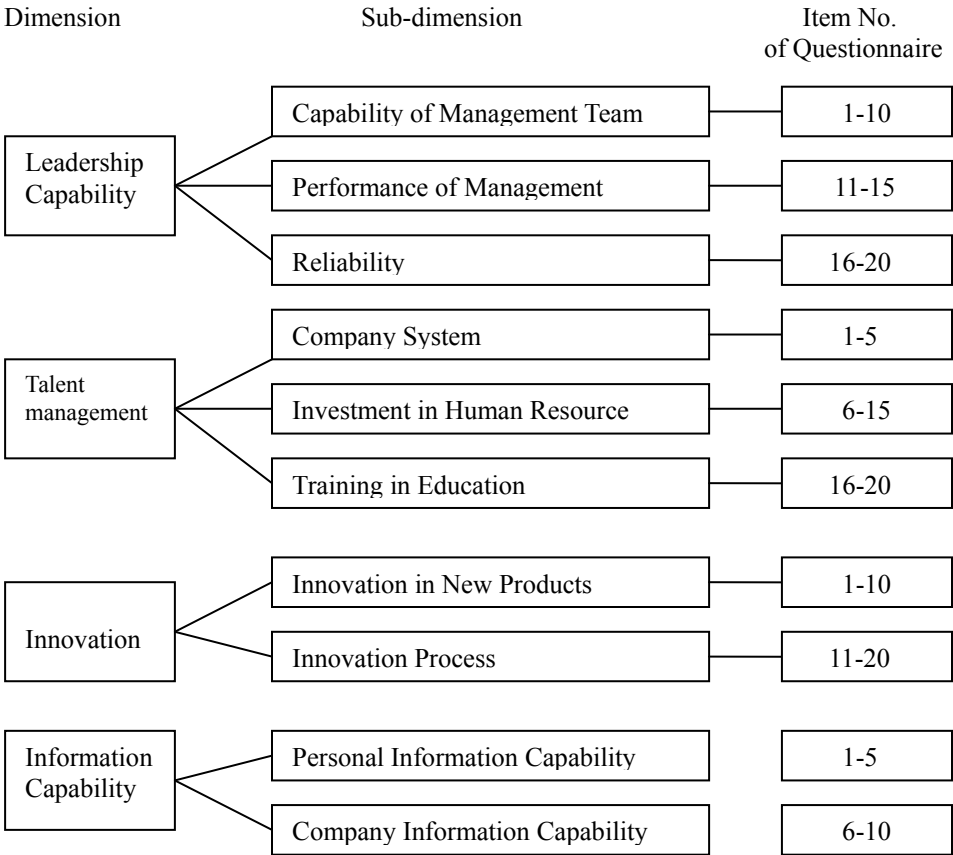
There has been very little research on the particularities of human capital in the household sewing machine industry. Relatively few studies have focused on similar industries. Achilles et al. (1997) investigate the human resources in the textile industry. Gereffi (1999) studies the apparel industry in Asia. Boschma and Wal (2005) examine human capital in footwear companies in south of Italy and suggest a strong local network position of a firm tended to increase employee's innovative performance. Even these sources lack explicit discussion on the difficulties that labor-intensive industry might confront. Due to changes in the economic environment in Taiwan, the labor-intensive industry began losing its competitive advantage on international production. There is thus a great need for studies clarifying the determinants of human capital in labor-intensive industry, especially the household sewing machine industry in Taiwan.

RESEARCH DESIGN AND METHODOLOGY

Research Framework

This research mainly focuses on the measurement of key factors in human capital through data gathering and analysis from the household sewing machine industry and related interviews, compiled specifically with relevant literature on human capital factors, through which human capital questionnaires are constructed and collected for further comprehensive descriptive statistics, reliability analysis, content validity analysis and factor analysis to inspect and filter out key factors for human capital. There are four key dimensions used to measure human capital: leadership capability, talent management, innovation, and information capability. The research framework is shown in Figure 1.

Figure 1: Research Framework

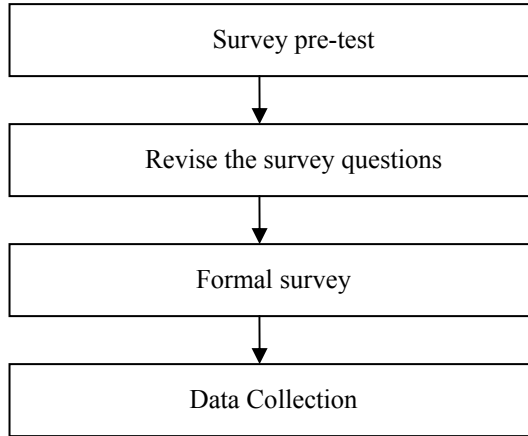| Dimension	Sub-dimension	Item No. of Questionnaire
Leadership Capability	Capability of Management Team	1-10
	Performance of Management	11-15
	Reliability	16-20
Talent management	Company System	1-5
	Investment in Human Resource	6-15
	Training in Education	16-20
Innovation	Innovation in New Products	1-10
	Innovation Process	11-20
Information Capability	Personal Information Capability	1-5
	Company Information Capability	6-10

This questionnaire was completed by the respondents based on their subjective understanding compared with that of their industry peers or competitors, with results labeled based on Likert's questionnaire as "disagree very much", "disagree", "no opinion", "agree" and "agree completely". The flow for the questionnaire test is shown in Figure 2.

Sample Selection and Data Sources

This research gathers data from various reliable sources in two phases. Phase 1 starts with an expert questionnaire targeting mainly managerial personnel (typically a group of experts such as human resource managers) at household sewing machine companies. After in-person interviews or phone conversations to outline research objectives, experts offer their assistance in order to construct key performance indicators for human capital. Phase 2 employs a formal questionnaire. This questionnaire is distributed using a written format and is also made available over the Internet to collect responses. The total number

of responses to the questionnaires was 53, two out of which were disqualified due to incomplete data, so that there were effectively 51 completed questionnaires.

Figure 2: Survey Flow Chart

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┌─────────────────────────────────────┐
│          Survey pre-test            │
└─────────────────────────────────────┘
                  │
                  ▼
┌─────────────────────────────────────┐
│       Revise the survey questions    │
└─────────────────────────────────────┘
                  │
                  ▼
┌─────────────────────────────────────┐
│           Formal survey             │
└─────────────────────────────────────┘
                  │
                  ▼
┌─────────────────────────────────────┐
│          Data Collection            │
└─────────────────────────────────────┘
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As for the research duration, this research was planned to conduct survey with targeted companies in July 2008, distribute expert questionnaires as associated with Phase 1 and compile the data into a formal questionnaire in August 2008, perform the formal questionnaire prediction in September 2008, release the formal questionnaire in November 2008 and then collect all questionnaires in December 2008.

Research Analysis Methods

The analysis in this research includes validity analysis, reliability analysis, descriptive statistics, factor analysis and one-way analysis of variance.

DATA ANALYSIS AND RESULTS

Content Validity Analysis

This research involved 11 experts in the questionnaire preparation process. They are very familiar with human capital or have much work experience with human capital. Seven of them are department head of human resource in the household sewing machine firms. Two of them are human resource managers. Two of them are college professors who have instructed the course of human resource for over ten years. This research uses the content validity ratio (CVR), combining all reactions from experts and describing the level of content quantitatively to validate the criticality of each questionnaire. The research also calculates the value of CVR for each project (Lawshe, 1975), with a possible minimum CVR value of 0.59, out of which 20 projects were valued under 0.59. Filtering questionnaires in this way has already increased the effectiveness of the research, helping us to complete the entire measurement questionnaires.

Descriptive Statistics

This research completes a content validity analysis after collecting the questionnaires, followed by a descriptive statistical analysis. Through descriptive statistical analysis, individual basic data and four dimensions are used to produce the mean and standard deviation (SD). This is explained as the following:

1. Gender statistics (see Table 2).

Table 2: Gender Statistics

Item	Content	Times	Percentage
Gender	Male	34	66.7%
	Female	17	33.3%

2. Age statistics (see Table 3).

Table 3: Age Statistics

Item	Content	Times	Percentage
Age	21-30	11	21.6%
	31-40	16	31.4%
	41-50	16	31.4%
	51-60	8	15.7%

3. Job statistics (see Table 4).

Table 4: Job Title Statistics

Item	Content	Times	Percentage
Job	Manager	5	9.8%
	Director, Rector	16	31.4%
	Team Leader	11	21.6%
	Others (ex：Engineering…)	19	37.3%

4. Education statistics (see Table 5).

Table 5: Education Statistics

Item	Content	Times	Percentage
Education	Senior High School	9	17.6%
	College	11	21.6%
	University	30	58.8%
	Graduates	1	2.0%

5. Seniority statistics (see Table 6).

Table 6: Seniority Statistics

Item	Content	Times	Percentage
Seniority	Within 1 year	5	9.80%
	1~5 year	8	15.69%
	6~10 year	9	17.65%
	11~15 year	8	15.69%
	16~20 year	13	25.49%
	Over 21 year	5	9.80%

6. In the statistical research on leadership capabilities, the highest mean appears for the management and operations teams, which communicate frequently to employees on company strategy and action plans, meaning that the measurement on this was given greater and more positive consideration, while the highest standard deviation (SD) corresponds to rapid inter-departmental collaboration, meaning that significant variations exist in the responses.

7. Through talent management and descriptive statistical analysis, we can see that the highest mean is contributed by companies that possess comprehensive compensation management principles and policies, while with a complete human resources strategy and policy, the standard deviation (SD) tends to be the largest, meaning that visitors have fairly different responses.

8. In innovation, the highest mean represents employees who tend to leverage information technology to promote collaboration, meaning that respondents give us high-quality evaluations, while the standard deviation (SD) is the largest when companies often leverage new technology to solve problems, meaning that the respondents have major differences.

9. In information capability, through such statistical analysis, the highest mean comes from employees who leverage information technology to assist with their work, meaning that more positive feedback is shared, while the standard deviation (SD) peaks for companies that often use new technologies to solve problems, meaning that the respondents have indicated major differences.

Reliability Analysis

In order to measure the reliability of this questionnaire, this research uses Cronbach's α reliability analysis. The value of Cronbach's α is based on Guieford's (1965) point of view that α<0.35 is considered to have low reliability, 0.35<α<0.7 is considered as average, and α＞0.7 as having high reliability.

According to the reliability statistics shown in Table 7, the reliability of the research on leadership capabilities is described using the α coefficient; its value is 0.936 for leadership capacity, 0.930 for talent management, 0.932 for innovation, and 0.903 for information capability. The overall value is 0.925, which allows us to conclude that all coefficients in this questionnaire have high reliability.

Table 7: Reliability Statistics

Dimension	Cronbach's Alpha	No. of Items
Leadership Capacity	0.936	16
Talent Management	0.930	11
Innovation	0.932	18
Information Capability	0.903	10
Overall	0.925	55

Factor Analysis

In general, the value of KMO is considered to be effective when is greater than 0.8 and at least greater than 0.5 when it is appropriate to conduct factor analysis. In addition, Bartlett's test of sphericity can be used to assist in data verification and ascertain whether the value of KMO is appropriate for the factor analysis method.

Table 8: KMO of Four Dimensions

		Leadership Capability	Talent Management	Innovation	Information Capability
KMO		.840	.843	.843	.831
Bartlett	Chi-square	743.835	394.600	656.691	389.096
	d.f.	120	55	153	45
	Significance	.000	.000	.000	.000

The KMO values of the four dimensions of this research are all above 0.8 (Table 8). According to Kasiser's proposed standard values, the KMO value in this research is appropriate for conducting factor analysis. Based on the results of KMO and Barlett's test of sphericity, the research proceeds to a subsequent exploratory factor analysis.

Table 9: All Factors along Four dimensions after Factor Analysis

Dimension	Factor	Name of Factor	Total Items
Leadership Capability	HL1	Capability of Management Team	8
	HL2	Performance of Management	5
	HL3	Cooperation Capability	3
Talent Management	HH1	Human Resource System	6
	HH2	Employee Feedback	5
Innovation	HI1	Innovation with regard to New Products	6
	HI2	Innovation with regard to Flow	6
	HI3	Investment Innovation & Management System	4
Information Capability	HT1	Information Environment	5

This research has four dimensions, i.e., leadership capability, talent management, innovation and information capability. Based on the results of the factor analysis, leadership capability can be further broken down into three factors, talent management into two factors, innovation into three factors and information capability into two factors. Please refer to table 9 for more information.

One-way Analysis of Variance

This research has four basic variants: gender, age, title, and education. After a series of ANOVA analyses using the basic questionnaire and results from the factor analysis, the conclusion shown in Table 10 is derived as the following:

- Education has little to no significance for all factors.
- Title has higher significance for all factors except information capability.
- Employee information capability is not affected by respondents' basic variants.

Table 10: ANOVA Analysis

Dimension	Factor	Sex	Age	Job	Education
Leadership Capability	Capability of Management Team	V	V	V	
	Performance of Management		V	V	
	Cooperation Capability	V	V	V	
Talent Management	Human Resource System	V	V	V	
	Employee Feedback	V		V	
Innovation	Innovation of New Products		V	V	V
	Innovation of Flow		V	V	
	Investment Innovation & Management System		V	V	
Information Capability	Information Environment		V	V	
	Employee Information Capability				

* V means significance

CONCLUSIONS

Taiwan's economic development had been considered as an "economic miracle" during 1960s to 1980s; meanwhile, the household sewing machine industry had become one of the largest exporters in the world. Due to changes in the economic environment in 2000, this industry began losing its competitive advantage on international production and was forced to relocate production to China.

This paper has provided empirical evidence and determinants of human capital relevant to household sewing machine industry in Taiwan. This research has uncovered several findings based on the investigation results and industry practices. First, this research proposes ten human capital key performance indicators variants applicable to the household sewing machine industry, most of which are both effective and reliable. After the reliability analysis, factor analysis and one-way analysis of variance, all key

performance indicator variants are proven to be reliable and effective. These ten key performance indicator variants are categorized into leadership capability and capacity, talent management, innovation, and information capability. Second, in practice world, respondents consider the human resource policy and system much less important. Third, in terms of the information capability dimension, employee information capability shows little to no significant variation with regard to gender, age, title, or education. Fourth, the variation based on the education of the respondents has little to no significance.

This research pinpoints the critical importance of effectively leveraging human capital to transform the business of household sewing machine companies. Through extensive research on related publications and literature, questionnaire investigation, and comprehensive data analysis, this research has found indicators covering four dimensions of human capital and its variations measurement. We have established appropriate and applicable human capital key performance indicators (KPIs) for the household sewing machine industry as follows. a. Leadership capability: build and manage teamwork, operational performance and constructive collaboration. b. Talent management: human resource policy and system, employee feedback. c. Innovation: new product innovation, workflow innovation, investment in innovation and management policy. d. Information capability: corporate IT environment, employee information capabilities.

In terms of practical implications, it can be said that as the demand for sewing machine is still continuing due to the monetary crisis in 2008 is recovering rapidly, Taiwanese household sewing machine industry need to make more accurate assessments of the determinants of human capital. This research has developed applicable human capital key performance indicators and established exploratory-driven factor analysis to measure human capital performance for Taiwanese household sewing machine industry. Currently, there are very few formal research publications on the sewing machine industry, with the primary focus on related product quality improvement, industrial production workflow and key factors for new product design. The research on human capital in household sewing machine industry has not been formalized in specific publications.

This research is subject to several limitations. First, this research draws a conclusion based on a sample that is not large enough. However, this research subjects for the questionnaire represent a group of companies that the Taiwanese Sewing Machine Export Association agreed to collaborate with. This association is a non-profit organization with the majority of large and medium Taiwanese sewing machine exporters as its members. Therefore, these companies are representative enough to generalize the finding to the entire Taiwanese household sewing machine industry. Second, this research has faced limitations in terms of resources and time. Therefore, it was almost impossible to conduct a comprehensive questionnaire investigation across all related sewing machine companies. With more time and resources, this research could have performed a wider range of research activities to gather more comprehensive research data.

According to the research principles and motivation, this research suggests two key points derived from the research results and data analysis. The first is that whether the Taiwanese household sewing machine industry should enhance its capabilities in talent management through thorough reliability analysis using questionnaires and descriptive statistics. This has been commonly considered by the industry or the respondents to be fairly insignificant. However, based on industry reports and expert debates, this particular industry has experienced significantly less talent compared to other industries. It is surprising to witness these two different results, which lead to some interesting notions

regarding whether an effective talent management system or practice exists in the Taiwanese household sewing machine industry, or whether other factors contribute to this contradictory situation. Therefore, subsequent research might need to incorporate this into further research. The second point is that whether the Taiwanese household sewing machine industry emphasizes on innovation. This research studies this specific industry by conducting research on industry reports and interviews with key industry experts, and it reaches a consistent conclusion that the Taiwanese household sewing machine industry needs to reinforce its innovation capabilities in product development. However, this research has not been able to prove that innovation has a significant effect, whether from descriptive analysis or from factor analysis. Instead, new product innovation has the lowest average factor score (3.40) among all other factors and the highest standard deviation (1.07).

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