

RESEARCH ON MEASURING HUMAN CAPITAL FACTORS -- AN EXAMPLE OF HOUSEHOLD SEWING MACHINE INDUSTRY IN TAIWAN

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Abstract: Taiwan, one of the largest exporters of household sewing machine in the world, has witnessed its sharp decrease in export volume since a majority of manufacturers moved their production to China in 2000. Due to such industry shift, the role of this industry in Taiwan has been gradually transferring from manufacturing to sales & operations. Therefore, this research focuses on the evaluation factors of human capital in household sewing machine industry in Taiwan. First, this research combines both human capital theories from eastern and western scholars, specifically in terms of evaluation factors and in attempt to analyze household sewing machine industry in Taiwan through the leadership capability, talent management, innovation, and the capabilities in information. What's more, the questionnaire was inspected by 11 experts specialized in household sewing machine industry and human resource management. The interviewees were listed in "TAIWAN HOUSEHOLD SEWING MACHINE EXPORT ASSOCIATION" and qualified for this research. The findings of this research are 1. Confirm the variable. 2. Interviewees do not value the system of human resource management. 3. In the capability of information aspect, sex, age, position, and education of the interviewees are not relevant to the employees' capacity of information. 4. The interviewees' education is not relevant to the variable.

Key word: Human Capital, Household Sewing Machine industry.

1. INTRODUCTION

Taiwan was a leading nation in exporting sewing machines in 1970s, with annual export volume of 3,160,000, 50% of total world output. Since 2000, the export of sewing machines has continuously witnessed major drop in Taiwan, the previously world leader in this industry comprised of many world class sewing machine manufacturers was forced to relocate from Taiwan to Mainland China, Vietnam and other similar locations in order to lower manufacturing cost, mainly due to its inability to rapidly improve product quality, enhance its own competitiveness and related technologies. As a result, China has successfully replaced Taiwan in its leading position in this industry.

With such major shift in the industry, Taiwanese sewing machine companies have transformed themselves from purely manufacturing capabilities to global operations of distributed manufacturing, sales and marketing, etc. Due to such dramatic change, effective resource allocation and training have played a critical role at many Taiwanese sewing machine companies. Therefore, it appears fairly interesting and important to research on the impact of human capital management to the household sewing machine industry in Taiwan.

Typically, household sewing machines are classified into three categories based on the sales volume. Taiwanese household sewing machine industry focuses primarily on manufacturing low-end household sewing machines. One of the primary reasons for this research is that majority of such sewing machine companies don't own brands, typically in much smaller scale, lack product research and development capabilities, also face many patent issues, many of which have contributed to Taiwan's lack of ability to develop new technologies and products to penetrate into high-end markets. The entire sewing machine industry in Taiwan was constantly frustrated and challenged by these critical issues such as how to reinforce ability to develop high-end products, how to enhance manufacturing technologies, training issues around multi-national businessmen. 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 in sewing machine industry.

This research involves member companies from Taiwanese Sewing Machine Export Association, and employs questionnaires to achieve the following objectives:

- 1 Establish applicable human capital measurement indicators for Taiwanese sewing machine industry.
- 2 Understand the point of view of Taiwanese sewing machine industry towards human capital.
- 3 Aim to help Taiwanese sewing machine industry understand how to leverage human capital more effectively; in addition, contribute to the human capital management in Taiwanese sewing machine industry and provide relevant suggestions.

2. LITERATURE REVIEW

2.1 Development of human capital concept

The concept of human capital was originated from Schultz's "Investment in Human Capital" published in American Economic Review in 1961. Schultz thought that human capital involved technology, experience, and knowledge. After that, Becker authored a book called "Human Capital" in 1964, formally recognizing the significance of human capital as a dedicated research subject.

With much contribution from the Nobel winner and economist, Schultz's introduction of the concept of human capital in 1979, Schultz had illustrated based on the analyses on a large quantity of case studies, that human resource was one of the foremost resources while investment in education and training as the main component of human resource investment. Schultz thought that the achievements from education represented the benefits from human capital, namely human capital itself.

On the other hand, Becker thought that investment in human capital came from all investments to improve human resource, and monetary income and consumption. Becker pointed out that organizations could manage and invest in human resource in order to further grow such human capital, recognizing higher potential of employee contribution. Such investment in human capital will result in higher employee productivity and organizational performance.

Since 1999, US federal government started to replace human resource with human capital in many publications and reports. With the arrival of the knowledge economy, the renewed understanding of human capital has produced much positive impact.

2.2 Definition of human capital

Human capital is an intangible resource and has been viewed and defined by researchers and organizations in a number of different ways. Schultz, the first author, thought that human capital involved technology, experience, and knowledge. Becker (1964) further define human capital as the knowledge, skills and abilities of employees.

Brooking (1996) : human centered assets refer to skills and expertise, problem solving ability, leadership styles and abilities and everything that is embodied in the employees.

Stewart (1997) : human capital refers to the ability of individuals to apply solutions to customer's needs, attributes, competences and mindsets.

Roos, Edvinsson, & Dragonetti(1998) Human capital includes competence , attitude and intellectual ability.

Edvinsson & Malone(1999) : Human capital includes the ability, knowledge, skills and experiences of employees and managers. It incorporates knowledge, skills, innovation and the individual employee's ability to handle his/her task, and also includes the firm's value, culture, and philosophy.

Davenport's (1999)human capital consists of four major components. First, Ability: proficiency in a set of activities or forms of work, including the subcomponents of knowledge, skills and talent. Second, Behavior: observable ways of acting that contribute to the accomplishment of a task. Third, Efforts: conscious application of mental and physical resources toward a particular ends. Forth, Time: the chronological element of human capital investment, including hours per day, years in a career, or any unit in between.

Dess & Picken (1999) defined that human capital was deeply embedded and was inseparable from abilities, knowledge, skills or experience. They categorized human capital such as action skills, information gathering skills, information processing skills, communication skills, experience, knowledge, social skills, views on value, belief and attitude.

Knight (1999) : human capital is the expertise and skill of employees.

Dzinkowski (2000) human capital is related to people's know-how, ability, skills and expertise in the organization.

Lynn(2000) : human capital embraces all the skills and capabilities of the people working in an organization, it can be seen as an inventory of individual's skill and knowledge within an organization.

Barney (2002) thought that human capital was a collection of training, experience, judgment, wisdom, relationship and insights from the company's managers and employees.

Nalbantian (2004) considered that human capital existed in the universal form and corporate form.

Wikipedia (2008) : refers to the stock of skills and knowledge embodied in the ability to perform labor so as to produce economic value. It is the skills and knowledge gained by a worker through education and experience. Many early economic

theories refer to it simply as labor, one of three factors of production, and consider it to be a fungible resource -- homogeneous and easily interchangeable. Other conceptions of labor dispense with these assumptions.

In summary of human capital research and definition by researchers and organizations above, human capital is considered as the company asset that includes all resources based on human, ranging from corporate value, culture and philosophy, and internal management classes and all employees who possess experience, professional knowledge and special skills, along with their individual attitude, belief and behavior, and the overall irreplaceable capital to help foster organizations to develop creativity. In another word, human capital represents the combination of technological accumulation and individual knowledge. Furthermore, human capital refers to the people that possess skills, experience and knowledge and are of economic value to organizations. When it comes to management and development of human capital, organizations should spare no efforts to uncover creativity, professional skills, and loyalty and informal interactions between organizational management teams, from their internal employees. It is one of the most important focus areas for most companies to realize how to retain talents to accumulate corporate human capital in order to obtain much needed competitive advantage.

2.3 Measurement of human capital factors

Known researchers, organizations and management consulting firms think that the key performance indicators for human capital should be the following:

Skandia (1998) use indicators such as leadership index, motivation index, empowerment index, 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 employees under 40, average training days per year, proportion of employees working in associated companies.

Wah (1999) Edvinsson & Malone(1999): the measurement factors are employee productivity, company investment in training, employee education and credentials, professional background and years of working experience.

Sveiby(1999) use indicators such as number of years of profession, level of education, training and education costs, grading, age ,seniority.

Edvinsson & Malone (1999) use indicators such as leadership, motivation and empowerment index, number of employees, employee turnover rate, number of managers, number of long-term full time employees, average age of employees, employee familiarity with information technology, average number of days spent on training per year, number of long term full-time employees left per year, percentage of managers with high education...etc.

Grossman (2000) proposed 10 key performance indicators for human capital as revenue factor, voluntary separation rate ,human capital value added, human capital ROI, total compensation revenue percent, total labor cost revenue percent, training investment factor, cost per hire,. health care costs per employee, turnover costs.

Zwell & Ressler (2000) categorized the key performance indicators for human capital into basic skills for all key positions, managerial skills and senior management skills.

Ernst & Young (LeBlanc, Rich, & Mulvey ,2000) use indicators of human capital measurement such as strategy execution, reliability of management, quality of strategy, innovation, ability to attract talent , management experience, quality of executive compensation, knowledge leadership.

Stewart (2001) measures the efficiency of human capital. His measures include average year of service , average education level,. % with advanced degrees, hiring cost , IT literacy,. hours of training/employee, employee satisfaction, , employee turnover(separation) , innovation ability ,new colleague-to-colleague, relationships spawned. success of employee-suggestion program, value-added/employee.

Pablos(2002) use indicators such as employee overview , employee shift, education, promise and motivation, training result. PwC (2008) elements of human capital include leadership ability, employment contracts, talent management, learning and innovation.

Hugh Bucknall & Zheng Wei(2008) use key performance indicators in productivity and efficiency, recruiting and employee training, professional achievements and rewards.

3. Research design and methodology

3.1 Research framework

This research mainly focuses on the measurement of key factors in human capital through data gathering and analysis from household sewing machine industry and related interviews, compiled specifically with relevant literature in 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 in human capital. It falls into four key dimensions to measure human capital: leadership capability, talent management, innovation and information capability. The research framework is shown in figure 1.

This questionnaire has been completed by the interviewees based on their subjective understanding compared with their

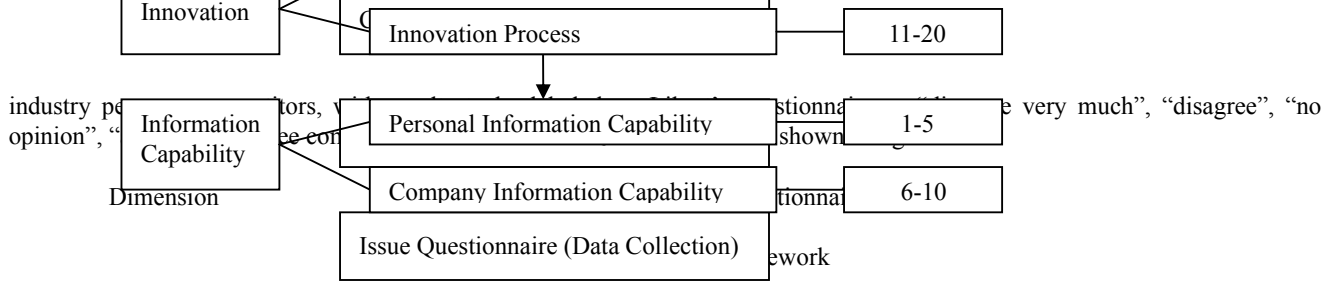


Figure 2. Questionnaire Flow Chart

3.2 Sample selection and data sources

This research gathers data from various reliable sources through two phases: Phase 1 starts with expert questionnaire, targeting mainly at 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 lend some help in order to construct key performance indicators for human capital. Phase 2 employs a formal questionnaire. This questionnaire is distributed via a written format and also made available over the Internet to collect responses. The total of responses to questionnaires is 53, two out of which were disqualified due to incomplete data, effectively 51 completed questionnaires.

As for the Research duration, this research was predicted to conduct interviews with targeted companies in July 2008, perform expert questionnaire of phase 1 and compile the data into formal questionnaire in August 2008, and perform formal questionnaire prediction in Sept. 2008, release formal questionnaire in Nov. and then collect all questionnaires in Dec.2008.

3.3 Research analysis methods

The analysis in this research includes validity analysis, reliability analysis, descriptive statistics, exploratory factor analysis (EFA) and ANOVA.

4. Data analysis & results

4.1 Content validity analysis

This research involved 11 experts in questionnaire preparation, many of whom came from household sewing machine companies such as department managers (7), human resources managers (2) and college professors (2). This research uses Content Validity Ratio – combine all reactions from experts and describe the level of content quantitatively to validate the criticality of each project. The research also calculates the value of CVR for each project that might get a minimum CVR value of 0.59, out of which 20 projects were valued under 0.59. (Lawshe establishing minimum CVR's at the $\alpha = 0.05$ significance level, $N=11$) Therefore, filtering such projects has already increased the effectiveness of the research, in order to complete the entire measurement project.

4.2 Descriptive statistics

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

1.

ITEM	CONTENT	TIMES	PERCENTAGE
Sex	Male	34	66.7%
	Female	17	33.3%

Table 1: Gender Statistics

2.

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%

Table 2: Age Statistics

3.

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%

Table 3: Job title statistics

4.

ITEM	CONTENT	TIMES	PERCENTAGE
Education	Senior High School	9	17.6%
	College	11	21.6%
	University	30	58.8%
	Graduates	1	2.0%

Table 4: Education statistics

5.

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%

Table 5: Seniority statistics

6. In the statistical research on leadership capability, the highest mean lies in management and operations teams communicate frequently to employees on company strategy and action plans, meaning the measurement on this was given higher and more positive consideration; while the highest standard deviation(SD) goes to rapid inter-departmental collaboration, meaning significant variations exist in responses.

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

8. In innovation, the high mean represents that employees tend to leverage information technology to promote collaboration, meaning interviewees give us high quality evaluation; while the standard deviation(SD) becomes largest when companies often leverage new technology to solve problems, meaning interviewees 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 more positive feedbacks are shared; while the standard deviation(SD) goes to peak when it comes to companies that often use new technologies to solve problems, meaning respondents have created major differences.

4.3 Reliability analysis

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

According to the reliability statistics show in Table 6. The reliability of the research in leadership capability is described using α coefficient – its value is 0.936, 0.930 for talent management, 0.932 for innovation, 0.903 for information capability. The overall is 0.925, which concludes that all coefficients in this questionnaire are of high reliability.

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

Table 6 : Reliability Statistic

4.4 Factor analysis

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

The KMO values of four dimensions in this research are all above 0.8. (Table 7) According to Kasiser’s proposed standard values, the KMO value in this research is appropriate to conduct factor analysis. Based on the results from KMO and Barlett’s test of Sphericity, the research proceeds to subsequent exploratory factor analysis.

This research has four dimensions including leadership capability, talent management, innovation and information capability. Based on the results from factor analysis, the leadership capability can be further broken down into three factors, and talent management two factors, innovation three factors and information capability two factors. Please refer to table 8 for more information.

		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

Table 7 : KMO of 4 Dimension

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’s Feedback	5
Innovation	HI1	Innovation of New Products	6
	HI2	Innovation of Flow	6
	HI3	Investment Innovation & Management System	4
Information Capability	HT1	Information Environment	5

Table 8 : all factors in four dimensions after factor analysis

4.5 Single factor variation analysis

This research has four basic variants including gender, age, title, and education. After analyzed using the basic questionnaire and results from factor analysis from 4.4 of this Chapter to conduct ANOVA analysis, the conclusion is shown in Table 9 and derived as the following:

- A. Education has little to no significance to all factors.
- B. Title has higher significance in all factors except information capability.
- C. Employee information capability is not affected by interviewees’ basic variants.

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’s Feedback	V		V	
Innovation	Innovation of New Products		V	V	
	Innovation of Flow		V	V	
	Investment Innovation & Management System		V	V	
Information	Information Environment		V	V	

Capability	Employee's Information Capability				
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* V means significance

Table 9 : ANOVA Analysis

5. Conclusion and future research

5.1 Research findings & contribution

The research has uncovered the following findings based on the investigation results and industry practices:

- A. Validate KPI variation: the research proposes ten human capital KPI variants applicable to household sewing machine industry, most of which have both effectiveness and reliability. After effectiveness analysis, reliability analysis, factor analysis and variation analysis, all KPI variants are proven to be reliable and effective. These ten KPI variants are categorized into leadership capability and capacity, talent management, innovation, information capability.
- B. In practice or real world, interviewees consider human resource policy and system much less important.
- C. In information capability dimension, employee information capability has little to no significance in variation to their gender, age, title, education.
- D. The education of the interviewees has little to no significance in variation.

Through extensive research on related publications and literature, questionnaire investigation, and comprehensive data analysis, this research has created indicators covering four dimensions in human capital and its variations measurement. By summarizing the results from data analysis, the primary research contribution includes the following:

- A. Establish appropriate and applicable human capital key performance indicators (KPIs) for household sewing machine industry:
 - a. Leadership capability: build and manage teamwork, operational performance, 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.
- B. Establish exploration-driven factor analysis to measure human capital performance.
- C. Develop applicable human capital KPIs for household sewing machine industry

5.2 Research Limitations

Currently, there are very few formal research publications on sewing machine industry, with primary focus on related product quality improvement, industrial production workflow and key factors on new product design, etc. Research on human capital in household sewing machine industry has not been formalized into specific publications.

Research constraints are mostly two parts as the following:

- A. The research subject for questionnaire is a group of companies that Taiwanese Sewing Machine Export Association agreed to collaborate with. This association is a non-profit organization, with mostly sewing machine exporters as its members. Therefore, these companies are not representative of the entire Taiwanese household sewing machine industry.
- B. This research has faced limitations in resources and time. Therefore, it is almost impossible to conduct comprehensive questionnaire investigation across all related sewing machine companies. With some more sufficient level of time and resources, this research could have performed a wider range of research activities to gather more comprehensive research data.

5.3 Future Research

According to the research principles and motivation, this research suggests the two key points derived from research results and data analysis: First, Whether Taiwanese household sewing machine industry should enhance its capabilities in talent management, through thorough reliability analysis in questionnaires and descriptive statistics, has been commonly considered by the industry or interviewees to be fairly insignificant. However, based on industry reports and expert debates in this industry, this particular industry has been experiencing a significant lack of talent compared to other industries. It is surprising to witness these two different results, which leads to some interesting notion on whether an effective talent management system or practice exists in Taiwanese household sewing machine industry, or whether other factors contribute to such contradictory situation. Therefore, subsequent research might need to incorporate this for further research work.

Second, Whether Taiwanese household sewing machine industry emphasizes on innovation becomes another key research topic. This research studies this specific industry by conducting research on industry reports and interviews with key industry experts, has reached a consistent conclusion that Taiwanese household sewing machine industry needs to reinforce its innovation capabilities in product development. However, this research has not been able to prove the innovation has significant effect, whether from descriptive analysis or factor analysis. Instead, the factor in new product innovation is the lowest (3.40) among all in terms of average, while a largest standard deviation (1.07). Such research result seems to contradict with industrial thoughts. Therefore, subsequent research might need to incorporate this for further research work.

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