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Human capital management using PAV (Personnel adjusted Added Value)

Hiroki Iwamoto and Masako Takahashi

***Abstract*— The objective of this study is to provide a quantitative technique by using Personnel adjusted Added Value (PAV) to help managers make decisions by objectively evaluating their Human Capital Management (HCM) and projecting profit increase generated by HCM. The approach of this study is divided into three steps. In the first step, PAV is defined as the corporate output. The data are classified into two groups by Cluster Analysis. In the second step, the factors which represent HCM practices are selected and formulated using Principal Component and Factor Analysis. In the third step, the multiple regression model is constructed to identify the HCM factors which influence PAV. This process establishes the model for objectively judging the success of HCM.**

***Keywords*—human capital management, intangibles, added value**

I. Introduction

In the 21st century, sources of revenue in developed countries, have shifted from tangible assets to intangible assets which are invisible [1]. Regarding the percentage of GDP in the United States, tangible investment was about 1.5 times higher than intangible investments in around 1980. However, around 2000, intangible investments had exceeded tangible investments [2,3]. The importance of the management of intangible assets is growing. On the other hand, a quantitative mechanism for measuring the contribution of intangible assets is not working in conventional evaluation system used in the management field.

A. Intangibles classification

Before considering the quantitative management system, the concept of intangibles must be organized and classified. Thereby, the target which should be focused on, is identified. Intangibles or Intangible assets are defined as follows in three typical fields dealing with intangible assets.

Hiroki Iwamoto
Graduate School of Keio University
Japan

Masako Takahashi
Keio University
Japan

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- Intangible resources in Business Administration

In the RBV(Resource Based View), the management resource which is a source of competitive advantage, is classified into five resources; financial; physical; personnel; organization and technology. The latter 3 resources corresponds to intangible assets [4].

- Intangibles in Accounting

The concept of Intangible assets in financial accounting has expanded into the concept of intangibles. The intangible asset is a claim to future income which does not have a form as a physical entity or financial instrument. Intangibles consist of human capital, structural capital and relational capital [5].

- Intangible capital in IC(Intellectual Capital)

In the IC, the intangibles is composed from the human capital and the structural capital, in order to express the corporate activities of intellectual industries [6].

Human assets or human capital is common in an overview of these major classifications of intangibles.

On the other hand, human capital enables companies to effectively use other tangible and/or intangible assets in the process of producing corporate values. Therefore, the above statement can be rephrased as synergies between human assets and other assets, there being a strong.

From the study above, This study focuses on human assets in view of the importance from among the intangible assets that quantitative evaluation is insufficient in measuring. Therefore, This study proposes quantitative evaluation methods of company management .

B. Previous Research of Human capital

Research of the definition of the cost of human capital and the method for measuring the cost of human capital has been made and it focuses on methods and framework in the human capital field [1, 4, 5, 6, 7].

Roos et al. (1997) classified human capital into Competence (knowledge and technology of an employee), Attitudes (motivation and enthusiasm) and Intellectual agility (application skill of knowledge and technology) [6]. Although intellectual agility is the applying force to other things, Fujita (2007) has cast doubt on Intellectual agility because the relationship between Intellectual agility and Competence or Attitude is too deep [8].

The human resource management and organizational performance model is included in the previous research. This model analyzes an individual companies' case study choosing employees as a sample [9]. It shows what kind of human capital management is valid. However, it is difficult to measure quantitatively the impact of human capital management in the proposed approach and framework. Also,

there is a problem because every company is different, the results can not be applied to every company.

C. *Evaluation Index of Human Capital Management Result*

Past research mainly used sales or production for the purpose of human capital management evaluation [8]. These indices include external purchase costs that are not directly involved with human capital management. On the other hand, if net income and operating income are used for human capital management evaluation, the valuation deducts human capital value from corporate value. To assess human capital management, it is considered appropriate to use an additional value which is located between the two. However, there are several definitions of added value. The added value must be defined by the intended use.

II. Objective

Firstly, this study clarifies the positioning of human capital as a management resource while including the previous studies' errors. Moreover, it proposes a quantitative evaluation index that includes the contribution of human capital. The index is verified by analyzing from a statistical point of view which focuses on corporate management and human capital management.

The objective of this study is to provide a quantitative technique to help managers make decisions by showing human capital management evaluation results and the relationship between each indicator and human capital evaluation index from models that utilize human capital evaluation index.

III. Approach

A. *Definitions of Human Capital*

1) Management Resources Classification

This study adopts internal capital classification shown in Figure 1 that is in combination with an overview of approaches to intangibles in the previous chapter and human capital is classified into competence and attitude.

2) Companies Classification by Human Capital Structure

Effective human capital management varies with the differences in each human capital structure. Of course the differences in companies' industries are important, but, the differences in business types are more important. This study classifies companies by identifying their main business (chosen from operation, management, research and development) from the human capital structure point of view.

Specifically, in this study every company has the three-dimensional business type vector based on its percentages of employees to the corresponding major facilities which are classified into the main three business types using its list of major facilities in the annual securities report. The vectors are applied in a ward method Cluster Analysis for making company classifications according to business realities

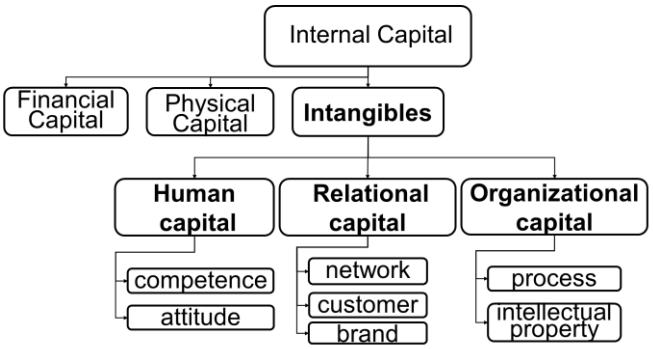

Figure 1. Internal Capital.

3) Personnel adjusted Added Value (PAV)

Added value calculation methods have mainly two types: deduction and addition. This study is based on the calculation method by the Small Business Administration that does not include intangibles as an expense, and financial income in the added value. It is a typical example of deduction method, which is calculated by subtracting the external purchase costs from sales. Labor costs are not included at all in the external purchase costs.

Concerning the evaluation of human capital management, the new hires, especially the unskilled workers from labor market are considered replaceable labor at the time of procurement. Their labor costs and labor forces are not the result of the company-specific management. Therefore, this study defines the labor costs for unskilled new employees as an external purchase cost. It would therefore be appropriate to assess the skill of human capital management. As a result, the labor costs are divided into basic labor costs and additional labor costs.

In Japan, there is simultaneous recruiting of new graduates. Therefore, new graduates' salary matches the salary of unskilled new employees. As a result, this study defines basic labor costs and additional labor costs as follows:

Basic labor costs: Expenditure in the case of hiring employees only from new graduates; only unskilled labor is regarded as external purchase.

Additional labor costs: Expenditure excluding the basic labor costs from total labor costs; this is regarded as the value of capabilities, and includes enclosure costs and training costs.

Based on these ideas, this study defines Personnel adjusted Added Value (PAV) as follows.

PAV = Sales - Initial cost

Initial cost = Selling and administrative expenses + Total production cost + The goods of purchases - R&D expenses - Advertising expenses – Additional labor cost

Additional labor cost = Personnel expenses - Starting salary multiplied by number of employees

Thus, PAV includes the value of human capital capacity minus unskilled labor costs. Therefore, companies can assess human capital management by using PAV. And when job seekers research companies, by using PAV, they will know their potential for growth in each company and how companies assess their abilities.

B. *Structure Extraction of Human Capital Valuation Structure*

This study has two steps. The first step is creating indices that represent the human capital by using a statistical approach. The second step make models that express efficient human management using Multiple Regression Analyses.

1) Determination of Human Capital Representation Index

Referring the guideline for the disclosure of intellectual property management by Ministry of Economy, Trade and Industry (METI), human capital indices are chosen from CSR reports, Annual reports and Securities reports [10, 11]. In particular, the payment structure indices of each company, which are mentioned as essential in the previous research, are estimated using data from the Ministry of Health, Labor and Welfare and starting salary [12]. To integrate the factors of real human capital, Factor Analysis is applied to all the above indices. Every coefficient of each factor is divided by its standard deviation to simplify factor scores.

2) Human capital contributing to PAV

Models use variables that are two types of indices. The first indices are created in step1. The second indices are thin-relation indicators with other indices. This study performs a Multiple Regression Analysis using a stepwise method for the objective variable PAV.

C. *Analysis subject*

This study focuses on 96 nonmanufacturing companies, 114 manufacturing companies that were listed in Japan in 2008. Financial results from 2008 to 2012 are also supposed to correspond to human capital management in 2008. Table1 shows focusing companies by industries. It should be noted that the number of control variables is subject to the number of sample companies in this study. Therefore, the flowing models have different control variables.

TABLE I. COMPANIES BY INDUSTRIES

Industry	Companies
Manufacturing	114
Non-manufacturing	
Construction	17
Information & communication	15
Transport	3
Wholesale & retail trade	41
Finance & insurance	4
Real estate & goods rental	6
Accommodations, eating & drinking services	5
Education, learning support	1
Medical, health care & welfare	1
Services	3
Total	210

IV. Results and discussions

A. *Company Classification and PAV Evaluation*

1) Company Classification Evaluation

As a result of the Cluster Analysis, the companies were classified into operation entities 178 companies (□) and the management entities 32 companies (Δ). (Fig. 2)

The two clusters indicate that the business type vectors in companies are divided into operation and management rather than research and development. Management Cluster consists of the companies engaged in managing. For example, franchise companies and holdings companies. The useful skills of employees between management companies and operation companies are different. Therefore, the effective measures to explain human capital management will also differ.

2) PAV Evaluation

The first four lines in Table 2 show a comparison of PAV by industry (manufacturing / non-manufacturing) and by main business (operation / management). The main business classification represents a more significant difference than the industry classification. Therefore, for the purposes of this study, the companies are divided based on the main business classification, and the industry classification is used as a control variable in the following statistical analyses.

The last two lines in the Table 2 show that the variance of PAV is smaller than the Small Business Administration's AV, and that the difference in AV in the main business classification is less significant than that of PAV. This indicates that PAV has increased the difference between the companies due to the structure of human capitals. The analysis using PAV will produce useful results for individual companies.

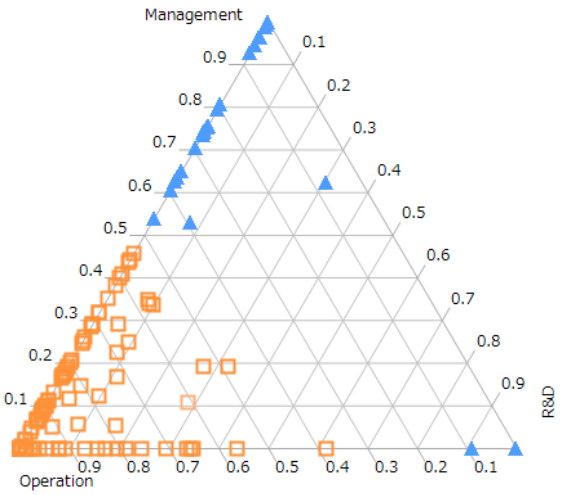

Figure 2. Company classification by main business.

TABLE II. BASIC STATISTICS OF ADDED VALUES

	Classification	Average	Standard error	Median	Standard deviation	P –value (>|t|)
PAV	Manufacturing	4.31	0.027	4.36	0.288	0.0228
	Non-manufacturing	4.27	0.028	4.18	0.275	
	Operation	4.34	0.022	4.23	0.300	0.0109
	Management	4.24	0.029	4.22	0.161	
AV	Operation	4.04	0.043	4.01	0.567	0.0577
	Management	3.86	0.081	3.94	0.457	

TABLE III. HUMAN CAPITAL FACTORS

Factors	Indices	Coefficients
Pay at and over 35	Pay at 35	0.767
	Pay at 40	0.901
	Pay at 45	0.938
	Pay at 50	0.964
	Pay at 55	0.962
	Pay at 60	0.937
	Pay at 65	0.792
Pay for young employees	Pay at 25	0.959
	Pay at 30	0.939
Employee liquidity	Average length of service	-0.371
	Mid–career percentage	0.725
	Director's shareholding ratio	0.704
	Employee turnover rate	0.486
	Employee turnover rate(first three years)	0.464
Female employment	Female employee percentage	0.689
	Female manager ratio	0.887
	Female executive ratio	0.624
Paid holiday	Average days of paid holiday acquired	0.901
	Acquisition rate of paid holiday	0.969
Overtime	Monthly average of overtime	0.970
	Overtime pay	0.813
Internal system	In-house staff recruitment system	1.000
	Study program in Japan	1.000
	Study programs overseas	1.000
Manager generation	Percentage of employees in 40s	0.659
	Percentage of employees in 60s	-0.415
Structure of employees	Average age	0.911
	Average length of service	0.672
	Percentage of employees under 30	-0.941
	Percentage of employees in 40s	0.637
	Percentage of employees in 50s	0.684
	New graduate percentage	-0.667

B. *Human Capital Valuation Structure*

1) Factors Representing Human Capital

After Principal Component Analysis, Factor Analysis is conducted where the cumulative contribution ratio of principal components is more than 70%. Every factor in Table 3 is summarized with highly influential indices.

Some important items such as employee liquidity and female employment which are problems in Japan, are listed as highly influential factors.

2) Human capital contributing to PAV

Table 4 shows the result of Multiple Regression Analysis of the operation cluster companies.

The female employment factor shows the availability of opportunities for advancement for female employees high availability improves motivation. Therefore motivation has a positive effect on PAV.

The number of employees shows the economies of scale.

Pay range at 30 indicates that employees prefer to receive stable salaries and wages rather than results-oriented pay.

The pay at and over 35 factor indicates that increasing mid-level employee's wages raises motivation.

Personnel expenses per employee show the amount of money that the companies invest in employees. Investment in employees increases their motivation and ability.

The internal system factor consists of in-house staff recruitment system, study program in Japan and study programs overseas. Systems for employees to grow have a positive effect on the PAV.

The free agent system is a system in which highly rated employees can choose to move to a different department, to further improve their rating. Free agency system seems to have a negative impact on PAV when general employees are majority.

The stock options have a negative impact on PAV. In Japan, because the percentage of individual investors in the stock market is low, salary seems to be better than stock.

The paid holiday factor indicates that paid holidays increases corporate productivity.

Overall, if operation companies give young and mid-level employees more benefits, it will have a positive effect on PAV. Systems that create a difference between employees of the same age(for example, mid-level employee and mid-level employee or young employee and young employee) are considered to have a negative effect on PAV.

Table 5 shows the result of Multiple Regression Analysis of management companies. It shows that the free agent system has a positive effect on PAV, and that higher pay for young employees and employee liquidity have a negative impact. This represents the characteristics of the management companies such that many management business operations are company-specific and low liquidity will increase PAV.

Comparing operation companies and management companies, structure which give benefits to general employees increases PAV in the operation companies, and structure which gives benefits to management employees increase PAV in the management companies.

TABLE IV. MULTIPLE REGRESSION MODEL OF PAV (OPERATION)

	Variables	Coefficients
	Intercept	3.54 E-0***
Structure of employees	Female employee factor	2.11 E-2**
	Number of employees	7.99 E-5***
Salary and welfare	Pay range at 30	-2.96 E-7**
	Pay at and over 35 factor	2.11 E-2**
	Personnel expenses per employees	2.57 E-2***
Internal systems	system factor {2 or more}	4.70 E-2**
	Free agent system	-3.04 E-2
	Stock option	-3.31 E-2*
Paid holiday	Paid holiday factor	2.44 E-3**
Control variables	R&D budgets	-3.53 E-6***
	Advertising expenses	6.72 E-6○
	Major shareholders	4.64 E-3
	Financial institutions	1.20 E-0*
	Years since establishment	-5.05 E-4
	Years since establishment	3.52 E-3
	Manufacturing / non	-4.59 E-2**
	Initial costs 5 year average	3.62 E-8

Significance level ***:0.1%, **:1%, *:5%, ○:10%, Adjusted R^2:0.780

TABLE V. MULTIPLE REGRESSION MODEL OF PAV (MANAGEMENT)

	Variables	Coefficients
	Intercept	6.01 E-0***
Structure of employees	Employee liquidity factor	-1.60 E-2**
Salary and welfare	Pay at 22	-5.89 E-6**
	Young employees factor	-1.84 E-2*
Internal systems	Free agent system	1.10 E-1***
Control variables	R&D budgets	1.13 E-5***
	Advertising expenses	4.98 E-5***
	Manufacturing / non	-4.42 E-2*
	Initial costs 5 year average	2.78 E-3

Significance level ***:0.1%, **:1%, *:5%, ○:10%, Adjusted R^2:0.882

v. Concluding remarks

This study proposes the Personnel adjusted Added Value (PAV), which enables to the analysis of corporate performance in terms of human capital management. Managers will be able to recognize the success or failure of their human capital management when they apply the proposed model to their own company's data.

Sensitivity Analyses on these models provide some suggestions. One is "How to increase PAV". Another one is "How to compare human capital management". The models show human capital management indices which are necessary to be compared with other companies' data. Managers will also be able to compare their human capital management structures with other companies by using public information.

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About Author (s):

Hiroki Iwamoto is a postgraduate in Centre for Open Systems Management, School of Science for Open and Environmental Systems at Keio University, Japan. He received Bachelor's degree in Administration Engineering at Keio University.

Masako Takahashi is a professor in the Department of Administration Engineering, Faculty of Science and Technology at Keio University, Japan. She received her Doctor of Philosophy in social system engineering from Keio University. She has published various articles and presented at national and international conferences on management science. Her recent research focuses on sustainable management and accounting.