

**MONETARY HUMAN CAPITAL MEASUREMENT:
EMPIRICAL EVIDENCE FROM THE GERMAN DAX 30 COMPANIES**

Paper Accepted and Presented at the
Academy of Management 2007 Conference in Philadelphia, PA, USA

CHRISTIAN SCHOLZ

University of Saarland / Germany
Department of Management
Chair for Organizational Behavior and Human Resource Management
Mail: Postfach 15 11 50, D-66041 Saarbrücken, Germany
Phone: ++49-681-302-4120, Fax: ++49-681-302-3702
E-mail: scholz@orga.uni-sb.de

VOLKER STEIN

University of Siegen / Germany
Department of Management
Chair for Human Resource Management and Organizational Behavior
Mail: D-57068 Siegen, Germany
Phone: ++49-271-740-3227, Fax: ++49-271-740-2637
E-mail: volker.stein@uni-siegen.de

STEFANIE MÜLLER

University of Saarland / Germany
Department of Management
Chair for Organizational Behavior and Human Resource Management
Mail: Postfach 15 11 50, D-66041 Saarbrücken, Germany
Phone: ++49-681-302-4726, Fax: ++49-681-302-3702
E-mail: sm@orga.uni-sb.de

Monetary Human Capital Measurement: Empirical Evidence from the German DAX 30 Companies

ABSTRACT

Human Capital Management is gaining growing relevance in Strategic HRM as a systematic instrument to analyze and improve HRM quality and performance. Especially the monetary value of the corporate human capital serves as an important lead indicator. In spite of recent theoretical developments in measuring human capital values, it is still an open question whether they really indicate the impact of human resource management practices on firm performance. Therefore, this conceptual as well as empirical paper explains a monetary human capital measurement system. Data from the German top companies of the DAX 30 stock index are used to empirically assess its measurement quality. As a major result, exceeding the impact of single HRM methods on organizational performance, our findings highlight the measurable influence of a whole set of interconnected human capital indicators on corporate performance.

Keywords: *human capital management; HR performance; Strategic Human Resource Management*

THEORETICAL BACKGROUND

Human Capital and Firm Performance

It is broadly accepted that people decisively contribute to corporate success (e.g., Pfeffer, 1994; Hitt et al., 2001) – and so does Human Resource Management (HRM) (e.g., Pfeffer, 1995; Ulrich, 1997). There is a constantly growing number of empirical evidence on these contributions (e.g., Huselid, 1995; Wimalasiri, 1995; Delaney, & Huselid, 1996; Becker, & Huselid, 1998; Barrette, & Ouellette, 2000). These findings became the foundation of Human Capital Management (HCM) in which human resources are perceived as a specific sort of intellectual capital (e.g., Edvinsson, & Malone, 1997) and Human Resource Management as an investment into this capital (e.g., Schultz, 1961; Becker, 1962). Given that analogy to financial capital, two research lines developed:

One recent trend specifies the driving HR forces to corporate success. It results in a number of key performance indicators and performance drivers like annual training hours or the degree of variable payment (e.g., Becker, Huselid, & Ulrich, 2001) which are able to leverage HRM efforts. “Human Capital Management” in this view is seen as the description, combination and regulation of key performance indicators.

Another recent trend connects HRM performance with the company value. If excellent HRM increases corporate performance, it should be possible to identify the directly induced influences on the corporate value (e.g., Fitz-enz, 2000). “Human Capital Management” in this view is seen as monetary assessment of investment decisions in human capital, based on a clear measurement of the human capital.

Literature Review on Human Capital Measurement Systems

The approaches to measure human capital have differentiated during the last years. However, to measure human capital is not as easy as it sounds. Not all of the offered measurement systems are really able to measure. Some approaches are rather re-labeled HRM systems, some are more or less intuition based technologies, some approaches just copy successful best-practices, and some of them are mainly a collection of isolated key performance indicators which are seen as value drivers for a human capital reporting.

However, the number of sense-making approaches of human capital measurement is growing. Comparisons (e.g., Mayo, 2001; Sveiby, 2002; Scholz, Stein, & Bechtel, 2004) reveal that there are mainly five groups of approaches on human capital measurement which build the current state-of-the-art:

Approaches which focus on the market value of companies try to assess human capital by drawing on the market value, the book value, and the number of employees. Early approximations like the difference between current market value and book value or the relation between market value and book value (e.g., Stewart, 1997: 224-225) turned out to be too rough estimations. Human capital is not only a residual value of financial data, but a synthetic value which aggregates several characteristics of people and of HRM activities. The Human Capital Market Value (e.g., Fitz-enz, 2000: 38) adds the application of full-time equivalents, and even changes in Tobin's q (e.g., Tobin, 1969) are interpreted as changes in human capital performance of a company (e.g., Sveiby, 2002).

Approaches which focus on accounting try to integrate the human capital measurement into the traditional accounting and balancing and therefore orient at the well-known depreciation.

Examples are measurement systems like Human Resource Accounting (e.g., Flamholtz, 1973) and Accounting For The Future (e.g., Nash, 2003), which foster the analogy of human capital and costs. One of the advantages is that human capital can be imaged as an investment account and that personnel costs are not the only substantiation of human capital but notwithstanding a very important one.

Approaches which focus on HR indicators collect a broad range of indicators which are more or less connected with corporate performance. Because the sets of indicators can be chosen at will, the broad range of proposals like Intellectual Capital Navigator (e.g., Stewart, 1997), Skandia Navigator (e.g., Edvinsson, 1997), HR Scorecard (e.g., Becker, Huselid, & Ulrich, 2001) and Human Capital Indicator (e.g., Mohr, & Keilholz, 2001) are not able to compare the results among each other. Aiming at isolated HR effectiveness indicators which are easily available, their merit is that they have created the general awareness for the necessity to deal with immaterial assets.

Approaches which focus on the added value try to link human capital to the added value surplus caused by employees. Examples for this approach are Market Value Added (e.g., Harvey, & Lusch, 1997) and Economic Value Added (e.g., Stewart, 1991; Young, 1997) as well as Workonomics (e.g., Boston Consulting Group, 2001) or Knowledge Capital (e.g., Strassmann, 1999). They are based on information which is delivered by the internal accounting function and are easy to calculate because it is mostly a difference between output and input. This is the reason why it is relatively easy to implement them in companies. Nevertheless, it is mostly a rough indicator in the HRM context because it is clearly focused on market sales.

Approaches which focus on the market returns try to interpret returns as caused by the immaterial assets. Examples are the Human Capital Pricing Model (e.g., Bender, & Röhling, 2001) and the RoI of Human Capital (e.g., Fitz-enz, 2000). They apply parts of the capital market theory on human capital and especially highlight the risk components of investments in human capital. However, they are partly very theoretical or alternatively do not exceed indicator-based approaches far enough.

All in all, HCM is gaining growing relevance in Strategic HRM as a systematic instrument to analyze and improve HRM quality and performance. Especially the monetary value of the corporate human capital serves as an important lead indicator. A recent development is to focus on a monetary human capital measurement (e.g., Matthewman, 2006; Scholz, 2006; Syrett, 2006) in order to link it to the HR-related discussion around HR risks (e.g., Kobi, 2002), human capital protection, and HR value creation potentials (e.g., Low, 2000).

Objective of the Paper

The objective of this paper is to conceptualize a monetary measurement system for human capital which reflects the progress of the theoretical discussion. This measurement system should be applied to the economic reality by measuring the human capital of selected companies and then confronting the results with corporate performance data. The basic hypothesis is that such a human capital measurement system is only relevant for HCM if it shows that intensified HRM activities lead to increased human capital values and furthermore to increased corporate performance.

RESEARCH FRAME AND HYPOTHESES

Construction Logics of the Human Capital Measurement Model

Taking into account the interests of potential addressees of a monetary human capital measurement, i.e. first and foremost the HR direction as well as the corporate top management as the decision makers, but also the employees as the decision bearer, we can at present differentiate three paradigmatic logics. They reflect the proper sense of a human capital measurement when assessing which overall qualities of outcome for the company are likely. Whether a human capital measurement system is useful and effective depends on its general underlying assumptions. As it is holding true for every measurement system, the effectiveness can only be assessed if the overall purpose is set.

Cost accounting paradigm. The original logic behind human capital measurement is cost accounting. Starting with the Human Resource Accounting (e.g., Flamholtz, 1973), human capital is primarily assessed according to the input costs. The human capital rises if the pure sum of monetary investments into the workforce increases. Personnel costs then are distributed to cost units. The significance of the calculated results for human capital management is only given if human capital management is seen as a reduction of personnel costs. Therefore, a cost accounting method usually leads to cost-cutting and dismissals.

Surplus distribution paradigm. A second logic behind human capital measurement is the distribution of surplus. The value of employees is oriented at the output which they generate. The human capital value arises as a result of the remaining parts of the cash flow which have not yet been distributed to non-personnel performance drivers like e.g. the financial capital. This principle can be found in approaches like workonomics (e.g., Boston Consulting Group, 2001).

Its problem can be seen in the effect that any occasional sales fluctuation on the sales market, independent from the reasons, immediately changes the human capital although the staff is not changed. An oil crisis or a change in customer preferences could lower the human capital value just because the revenues are sinking, and negative revenues would lead to a negative human capital, even if the employees have not changed at all. A further arbitrariness results from the unclear prescriptions for the distribution of the surplus to different forms of corporate capital. It is almost impossible to isolate the surplus contributions of single production factors.

Performance potential paradigm. As a consequence of these difficulties, the necessity resulted to measure human capital independently from these two logical approaches at least for the HR management context, but also increasingly for financial evaluations. The appropriate and most recent logic is the performance potential paradigm. According to it, human capital has to reflect the performance potential which could theoretically be caused by the existing skill and capability pool represented by the whole staff. As a standardized value, the human capital value then represents the minimum value creation (but not the minimum sales on the market) which such a workforce is supposed to create. It can only be measured through core HRM activities with a clear performance relationship independent from the present entrepreneurial success on the sales market. This performance potential of a company therefore consists of the existing employees, priced with market salaries, of their equipment with up-to-date knowledge as well as of their motivational situation which is mainly influenced by HRM. The measured variables are not linked to business turnover: The value of the staff does not change automatically, if the enterprise gains or loses profit or if the stock price changes. Besides, the measurement cannot result in a negative human capital.

With the human capital measurement on basis of the performance potential paradigm, however, no statement can be made whether the company is to keep or abolish jobs, while the two other measurement logics imply a decision on a personnel reduction. The performance potential logic pleads from the beginning neither for a preservation of personnel nor for a dismantling.

Moreover, it does not ignore the income situation of the company, but it also does not attempt to conclude automatically from personnel costs or market sales to the human capital value of the staff.

To repeat the crucial point: By reflecting the three paradigms from above, any conceptualization of human capital measurement has to make clear which logic is behind the calculation of the human capital value. The three paradigms help to decide on the choice of measurement components.

At this point, however, it is not yet said anything about the effects of a high human capital. It should only be avoided through the performance potential paradigm, that human capital is defined by the market sales and later, one tries to correlate human capital with the corporate performance (e.g., market sales) and is satisfied if the correlation is positive and highly significant. Thus, in order to exclude fundamental measurement and interpretation mistakes caused by tautologies, the conceptionalists of such measurement systems (and later the applying companies) have to make transparent the underlying logic and to determine which components should be part of the measurement model and which components should be not. Like the Academy of Management 2007 Conference motto points out: “Doing well by doing good” is also inevitable in the field of HCM quality.

Components of the Human Capital Measurement Model

The definition of an HR-oriented, i.e. not primarily financially oriented, human capital measurement system which considers the performance potential paradigm calls for a combination of core HRM activities with a clear performance relationship. Reflecting the advantages and disadvantages of the existing human capital management systems from the literature on one hand (e.g., Mayo, 2001; Sveiby, 2002; Scholz, Stein, & Bechtel, 2004) and the requirements of the addressees on the other hand, the following four components seem to be absolutely essential to be considered: A value base consists of the existing employees, priced with market salaries, and recruitment as well as dismissals serve to regulate the workforce size and therefore the potential work capacity. Value depreciation indicates the losses of human capital investments by eroding knowledge over time. Value compensation reflects the continuous equipment with up-to-date knowledge in order to maintain corporate capability levels. Value adjustment covers the motivational situation of the employees which is mainly influenced by HRM and which aims to keep the work efforts high. These four components have to be expressed in monetary terms.

Value base. The value base is to be made up of the number of employees (full-time equivalents, *FTE*) as a quantity component and the market salary (w) as a price component. The choice of the market salary instead of the really paid salaries can be explained by the principle of caution which demands to state values with their replacement costs. It is also important to notice, that it would be irritating to use the real salaries which companies are paying: Companies could in that case theoretically increase their human capital value simply by raising the wages.

Value depreciation. Human capital measurement has to consider the valuable stock of knowledge related with the employees. But it is a risk component in HCM, since knowledge has

only a limited relevance. Increasing dynamics of technological progress result in a shortening of the half-life of knowledge (e.g., Giarini, & Liedtke, 1998: 113). That means that after a certain time, the individual knowledge which is brought from the educational system begins to erode. Expert knowledge and technical knowledge decrease, but at the same time, practical knowledge and experience increase. The resulting effect (the aggregate knowledge in figure 1 respectively its standardized variation on a 100 percent scale) still indicates a gradual knowledge loss which in its aggregation becomes relevant for the company. This depreciation of knowledge can be expressed as a relation between the job-specific duration of knowledge relevance and the length of employment ($f(k;t)$). Linked with the monetary human capital value base, it can itself be expressed as a monetary term.

Insert figure 1 about here

Value compensation. The depreciation of knowledge can be counterbalanced by personnel development. The costs for personnel development (*PD*) are a specific value compensation and therefore have to be added to the human capital value base.

Value adjustment. Finally, the value base is subject to further changes, since the motivation of the employees may change. These motivational value adjustment (*MA*) is due (a) to the individual commitment, i.e. whether the employees are willing to deliver their efforts, (b) to the contextual conditions, i.e. whether the employees are able to deliver their efforts, for example when they receive sufficient information or have stable team structures, and (c) to the retention

intentions, i.e. whether the employees are planning to stay in the company and are therefore not diverted by reorientation thoughts.

Formulation of the Human Capital Measurement Model

To receive the human capital value, the four elements (value base, value depreciation, value compensation, and value adjustment) now have to be calculated for all employees of the company. It is necessary to group the employees because several job clusters are supposed to show different durations of knowledge relevance or different motivational structures.

Applying the construction logic (1)

$$(1) \text{ human capital value} = \text{value base} - \text{value depreciation} + \text{value compensation} + \text{value adjustment}$$

with the components (2) to (5) as follows,

$$(2) \text{ value base} = \sum_{i=1}^g (FTE_i \cdot w_i)$$

$$(3) \text{ value depreciation} = \sum_{i=1}^g [FTE_i \cdot w_i \cdot (1 - f(k_i; t_i))]$$

$$(4) \text{ value compensation} = \sum_{i=1}^g PD_i$$

$$(5) \text{ value adjustment} = \sum_{i=1}^g [(FTE_i \cdot w_i \cdot (1 - f(k_i; t_i)) + PD_i) \cdot MA_i]$$

therefore, the aggregated human capital value can be expressed as (6).

$$(6) HC = \sum_{i=1}^g [(FTE_i \cdot w_i \cdot (1 - f(k_i; t_i)) + PD_i)] \cdot (1 + MA_i)$$

In order to compare the resulting human capital values from several companies and even from different industries, there has to be a standardization of the measurements. The way how these four components of the conceptualized formula can be measured will be described in the methodology section.

Hypotheses

To use such a human capital measurement construct, it will be important to assess three aspects:

First, are each of the components of the formula positively linked to corporate performance? If so, the formula will consist of provable key performance indicators. Therefore, the following hypotheses are proposed to assess the effects of the single formula components:

Hypothesis 1a: An increasing human capital value base consisting of the workforce size and its remuneration will increase corporate performance.

Hypothesis 1b: An increasing value depreciation will decrease corporate performance.

Hypothesis 1c: An increasing value compensation consisting of personnel development will increase corporate performance.

Hypothesis 1d: An increasing value adjustment consisting of commitment effects, work context effects, and retention effects, will increase corporate performance.

Second, is the specific combination of the formula systems again positively linked to corporate performance? If so, we can state that the effects of the single variables in the human capital

measurement system do not cannibalize each other but fit together as a systemic and holistic valuation approach. This would support the performance potential paradigm. The following hypothesis is proposed to assess the effects of the formula system on a whole:

Hypothesis 2: An increasing overall human capital value will increase corporate performance.

Third, it would be senseless to build complicated measurement systems based on the performance potential paradigm if the two alternative paradigms hold true. Therefore, it has to be examined that the personnel costs alone do not have the same force of expression like the human capital value on a whole. If so, the cost accounting paradigm would be supported although then contradicting the theoretical logic. Additionally, it has to be examined that the RoI on human capital has not the same force of expression like the human capital value on a whole. If so, the surplus distribution paradigm would be supported although then again contradicting the theoretical logic which points out that the HC RoI is caused by additional variables like the market sales. The following hypotheses deal with these considerations:

Hypothesis 3a: The overall human capital value per full-time equivalent is not positively correlated with the personnel costs per full-time equivalent.

Hypothesis 3b: The overall human capital value per full-time equivalent is not positively correlated with the HC RoI per full-time equivalent.

METHODS

Measures

Based on our conceptual model and in order to assess our hypotheses, we measure the different components of human capital as follows:

Groups of employees (i). An employee group is usually constituted along company-specific strategic lines. Most companies identify functional groups in the scope of their organizational structure and procedural organization. In our empirical study, group building is based on the business units of each company. Using the German job classification scheme, each person in any of the groups is characterized by its profession, because some variables like market salary and the duration of knowledge relevance are determined by it.

Full-time equivalent (FTE $_i$). Calculating the number of employees in a company as full-time equivalents seems to deliver more useful results than absolute headcount which is more difficult to interpret because of varying use of part time work. An advantage of a FTE thinking is that an increase in labor time will result in an increase of human capital. This effect would not appear if one relied on absolute headcounts. In our study, for companies which do not publish full-time equivalents, the FTE number will be calculated on the base of absolute headcounts by taking into account the average share of German part-time employees.

Market salary (w_i). In the price component we suggest taking profession-based market salaries representing the average total compensation for the respective job. Data of the German Federal Statistic Office which collects the gross annual salary of each profession are used for our analysis of German DAX 30 companies. Because the composition of the workforce can be broadly

approximated from available information about the companies, it is possible to calculate a market salary which takes into account the different jobs as well as the different education levels.

Duration of Knowledge Relevance (k_i). The duration of knowledge relevance specifies the time in which the achieved knowledge of a group of employees can be fully used to create added value on the current state-of-the-art of their specific job. For example, the knowledge of an IT specialist erodes faster than the knowledge of a gardener. For our study, the duration of knowledge relevance has been determined for more than 800 specific jobs on the basis of theoretical literature, expert interviews with researchers, and a standardized survey among professional associations. The information were connected in a data base which categorizes the duration of knowledge relevance along the requirements of knowledge-updates (table 1).

Insert table 1 about here

Firm tenure (t_i). It describes the average length of affiliation of the employee groups to the company. An increasing tenure implies – ceteris paribus – a trend of knowledge depreciation. In combination with the duration of knowledge relevance, it is able to express the knowledge depreciation. Some of the companies have published the average firm tenure. Other companies, which did not publish firm tenure, have been calculated with an average value of firm tenures in their respective industries (e.g., Gerlach, & Stephan, 2001: 21).

Personnel development (PD_i). The effective costs of personnel development activities are disclosed in internal accounting reports and can be derived quite easily from IT-Systems. Personnel development costs are for example costs for external seminars or for on-the-job-

trainings, expressed in training days and valued with overall charges for training days (e.g., Goldstein, & Ford, 2002). Our study uses different methods for the determination the personnel development costs depending on the availability of data. If companies show their total amount of personnel development costs, then the costs are subdivided to each group of employees. If companies show the average training days of the employees, then these training days are multiplied with an average cost rate of training days in Germany of 869 Euro (e.g., Weiß, 2001). The result is subdivided to each group of employees afterwards. If companies do not publish any data on their personnel development costs, the German average of 3.4 days per employee (e.g., Weiß, 2001) is taken. This value then transforms into the personnel development by multiplying it with the average duration of knowledge relevance in this employee group in order to take into account the varying degrees of personnel development effectiveness.

Motivation (MA_i). Motivation will be used as a multiplier in our human capital measurement system on a scale between -1 and +1 with 0 as the neutral value. Motivation represents in a wider sense the overall employee motivation on three subscales: (1) Indicators for the employees' commitment ("willingness") to contribute to the firm's strategic objectives can be found in corporate information like the business report or the social report, for example information about employee satisfaction surveys. (2) Indicators for the employees' ability to be productive in their group context ("opportunity") which verifies how working conditions, leadership style, HR processes, information structures or organizational routines enable people's contribution can be found in rankings like "the best employer to work for". We take the survey "trendemployer 2005" (trendence, 2005) on the German top-employers. (3) The retention scale, referring to the probability that the employees are available for the company in the long run ("availability"), can

be assessed for example by fluctuation rates. On all three subscales, we collect strong indicators and increase or decrease the motivation around the scale mean of 0.

Corporate Performance. The corporate performance is in our study measured by two established financial variables. The first is the EBITDA as the Earnings before Interest, Taxes, Depreciation, and Amortization. It is one measure of the operating cash flow. The second is the HC RoI from the Saratoga Institute (e.g., Fitz-enz, 2000), defined as $\text{Revenue} - (\text{Operating Expense} - [\text{Compensation Cost} + \text{Benefit Cost}]) / (\text{Compensation Cost} + \text{Benefit Cost})$. The data can be derived from company publications.

Personnel Costs. The personnel costs consist of the salaries and social insurance contributions derived from the corporate income statement.

Data Collection and Data Analysis

Our research is based on the collection of secondary data and on the summary of published measures of the German DAX 30 companies. The DAX 30 is the Blue Chip stock market index consisting of the 30 major German companies trading on the Frankfurt Stock Exchange. Because of their far-reaching publication obligations, it was possible to receive and re-calculate most of the required measures from publicly available data in business and sustainability reports. Table 2 shows the collected input data for the calculation of the human capital values. The reference date of our valuation is December 31, 2005. As a result, we calculate the human capital value of each company.

Insert table 2 about here

The statistical analysis of the data was supported by the "SPSS" statistical software. Frequencies, means, and standard deviations were computed to describe the measured variables. In addition, mainly product-moment correlations have been calculated.

FINDINGS

Regarding the results presented in table 3, first, we can see that most of the variables which are part of the human capital measurement system are significantly correlated among each other. The value base is correlated with the other components which is clear because on the level of absolute figures, the larger the company is, the larger are the value depreciation, the value compensation and the motivational value adjustment in absolute terms. Analogously, the overall human capital value in absolute terms is also connected with every single component on a highly significant level which is clear as well because this is the definition of the human capital value.

The findings for hypothesis 1a to 1d are presented in table 3, correlating the human capital components with the performance criterion EBITDA which is independent from the definition of the human capital value. There are significant, positive correlations between the EBITDA as performance indicator and the human capital value base (1a), the personnel development costs (1c) and the motivationally induced value adjustment (1d). However, the personnel development, understood as personnel development costs multiplied with the duration of knowledge relevance, was not significantly correlated with the EBITDA. But yet, these hypotheses have to be considered as supported. No support gained hypothesis 1b stating that increasing value depreciation would lead to decreasing corporate performance. No significant correlation could be

observed which indicates that the knowledge management is rather an internal affair of companies and does not directly affect market sales – at least on the short run.

Insert table 3 about here

As to hypothesis 2, the expected result of a significant positive correlation can also be read out of table 3. Corporate performance measured by the EBITDA is significantly positively linked with the overall human capital value. This indicates a basic validity of the overall measurement construct in respect to its predictive quality. Consequently, up to now, we do not only have a statistical control of the effects of most of the single factors, but also of the combined model.

Hypothesis 3a and 3b expected that there were no significant positive correlations between the human capital value per FTE on one hand and the personnel costs (3a) respectively the HC RoI (3b) on the other hand. The findings in table 4 show that there are in fact no significant correlations between these variables. Both hypotheses, therefore, have not to be rejected. It becomes obvious that the human capital value has a meaningfulness which is not parallelized with the pure cost accounting on one hand and with the pure surplus distribution on the other hand.

Insert table 4 about here

DISCUSSION

Advancements in Human Capital Measurement

Up to now, the Blue Chips in Germany do not publish their human capital in monetary terms, although about half of the DAX 30 companies have, as an extension of this study, recently calculated the human capital value of pre-defined parts of their workforce in a very similar way. However, it is not yet possible to find any information released to the public about the total amount of human capital which is the outcome of their investments in employees. From outside it is even much more difficult to get a first impression on the actual state of the human capital development in German companies. All the more the necessity becomes obvious that companies start to report all the data, not only for the purpose of shareholder information but also for the purpose of signaling a professional HRM to potential applicants.

Although the measurement of human capital seems to be too complicated for companies, from inside, the required data are very easy to obtain. The measurement can become interesting and important for a company if it helps to regulate the whole HR function and inspires a new thinking. An example would be the knowledge management where companies could only by measuring the knowledge depreciation determine the amount of money which will be necessary to invest in personnel development. Up to now, this decision on the personnel development budgets is mostly intuitively made.

The formula which has been conceptualized in our paper seems to measure what it is supposed to: the contributions of the workforce (and indirectly of the HR function) for the corporate capabilities. Therefore, reflecting the empirical results supporting this statement, the validity of the measurement is achieved. By the human capital measurement system of this study, an

important step has been made to perceive the whole HCM as a function reflecting the HR context in a systematic as well as in a systemic way. This model is systemic in this sense that it covers all major HR tasks like HR planning, recruitment, personnel development, remuneration, retention management, motivation and leadership and that changes occurring in one field directly influence the other fields.

The most important result of this study is that meaningful and up to some degree even valid values can be linked to a sense-making basic HRM logic. Taking the cost accounting paradigm or the surplus distribution paradigm, the calculated values of the human capital bear tautologies per definition. The only way to receive a comprehensive human capital value which could be a lead indicator for corporate performance is to base it on the performance potential paradigm which neither transports the paid wages and personnel costs nor the partly irrelevant market sales as performance outputs. The relevant human capital value ideally reflects the capabilities of the company which are caused by the existing workforce.

Limitations

The data availability was the major restriction to our analysis. The companies published a lot of performance data, but only very seldom data on personnel development costs and on motivation items. As long as all these companies cannot be interviewed directly, the used data have to be seen as approximations. However, as single checks have shown, the data “from outside” tend to meet the real data quite narrowly.

The differentiation of 800 jobs and their characteristics like average salary in Germany and duration of knowledge relevance might sound impressive, but this is still not differentiated enough as new job descriptions continuously emerge.

One methodological limitation is caused by the restricted number of the analyzed companies. 30 companies represent, although it is a complete census of all companies in the DAX 30 stock index, only a small extract from an economy like Germany.

In this context, we are aware of the limitation that our statistical analysis is only based on correlations. We would have preferred path analyses in order to deduce statements on the causalities, but again we would have needed a far bigger sample.

Because we worked on data of the DAX 30 companies which are large and successful, our conclusion may not generalize to smaller or less successful companies. An enlargement of this study, taking a control group consisting of smaller/successful and of large/less successful companies would be able to control the effects of size and overall success.

Up to now, we did not integrate the time delay effects of some variables into our conceptualization of the human capital measurement system. Obviously, there are time lags in the effects of dismissals or of motivational activities. We only observed one particular point in time.

CONCLUSIONS

Our study explored the contribution of a monetary human capital value to the performance-oriented regulation of the HR function. When top managers ask “Which are the changes in the present value of our staff?” the human capital value can give an answer which reflects the importance of HRM to the company. Although past research has documented the impact of single HRM methods on organizational performance, our findings highlight the measurable influence of

a whole set of interconnected indicators on corporate performance and at latest the company value.

We recognize that the measurement of a monetary value for human capital is possible. Most notably, our suggestion is an autonomous HR approach. Therefore, it exceeds financially oriented approaches which perceive human capital as not more than a residual variable to business success. With the aid of the human capital measurement system which is proposed here, regulation impulses for HRM can be derived. Moreover, such a measurement system strengthens the position of HR professionals in companies because they themselves will be responsible for the whole human capital management and prevent the financial department to take over methodological – and later content-related – control.

Calculating a monetary human capital value is for companies by no means an end in itself. It is supposed to serve the valuation of an enterprise as a whole, the determination of credit costs, the support of company ratings, the preparation of mergers and the HR due diligence, and the general professionalization of the HR function. Furthermore, it can be connected with a capitalization of human capital as an asset in the balance sheet (e.g., Divanna, & Rogers, 2005). Although this is still a future vision, it nevertheless can become realistic because the suggested standardizable valuation system could be reconstructed by certified public accountants from its basic logic to its detailed measurement regulations.

Our findings point to human capital measurement as a central construct in understanding the effects of knowledge management and in clarifying scale issues for knowledge investment decisions. Further, our findings highlight the role of human capital measurement in fostering “soft factors” like motivation for leadership while perceiving the “hard effects” of these

activities. Our research, then, suggests that human capital management is able to strengthen the performance contributions of the HR function and therefore needs not only to concentrate on personnel costs and the dismissal of employees in order to improve the cost/benefit-ratio of HR activities. At last, our findings support the theoretical discussion of human capital measurement paradigms, showing that the performance potential paradigm is not only theoretically sense-making but also empirically substantial.

REFERENCES

- Barrette, J., & Ouellette, R. 2000. Performance Management: Impact of the Integration of Strategy and Coherence of HRM Systems on Organizational Performance. *Industrial Relations*, 55(2): 207-226.
- Becker, B.E., & Huselid, M.A. 1998. High Performance Work Systems and Firm Performance: A Synthesis of Research and Managerial Implications. G. Ferris (Ed.) *Research in Personnel and Human Resource Management*, 16(1): 53-101.
- Becker, B.E., Huselid, M.A., & Ulrich, D. 2001. *The HR Scorecard. Linking People, Strategy and Performance*. Cambridge, MA: Harvard Business School Press.
- Becker, G.S. 1962. Investment in Human Capital. A Theoretical Analysis. *Journal of Political Economy*, 70(Supplement October): 9-49.
- Bender, C., & Röding, T. Ansätze zur Bewertung und Risikomessung von Humankapital. Kossbille, H. (Ed.). *Modellgestützte Personalentscheidungen*. Munich – Mering: Hampp: 27-39.
- Boston Consulting Group. 2001. Workonomics. Linking Human Resources and Shareholder Value. <http://www.bcg.com/workonomics/index.htm> (called 2003-07-01).
- Delaney, J.T., & Huselid, M.A. 1996. The Impact of Human Resource Management Practices on Perceptions of Performance in For-profit and Nonprofit Organizations. *Academy of Management Journal*, 39(4): 949-969.
- Divanna, J.A., & Rogers, J. 2005. *People – The New Asset on the Balance Sheet*. New York: Palgrave-Macmillan.
- Edvinsson, L. 1007. Developing Intellectual Capital at Skandia. *Long Range Planning*, 30(3): 366-373.

- Edvinsson, L., & Malone, M.S. 1997. *Intellectual Capital. Realizing Your Company's True Value by Finding Its Hidden Roots*. New York: Harper Business.
- Flamholtz, E. 1973. The Role of Human Resource Accounting in Social Accounting. Dierkes, M., & Bauer, R.A. (Eds.). *Corporate Social Accounting*. New York – Washington – London: Praeger.
- Fitz-enz, J. 2000. *The ROI of Human Capital. Measuring the Economic Value of Employee Performance*. New York etc.: Amacom.
- Gerlach, K., & Stephan, G. 2005. *Individual Tenure and Collective Contracts*. Institut für Arbeitsmarkt- und Berufsforschung (Ed.). Discussion Paper Nr. 10. Nuremberg.
<http://www.doku.iab.de/discussionpaper/2005/dp1005.pdf> (called 2007-13-01).
- Giarini, O., & Liedtke, P.M. 1998. *Wie wir arbeiten werden. Der neue Bericht an den Club of Rome*. Munich: Heyne.
- Goldstein, I.L., & Ford, J.K. 2002. *Training in Organizations*. Belmont, CA: Wadsworth.
- Harvey, M.G., & Lusch, R.F. 1997. Protecting the Core Competencies of a Company: Intangible Asset Security. *European Management Journal*, 15(4): 370-380.
- Hitt, M.A., et al. 2001. Direct and Moderating Effects of Human Capital on Strategy and Performance in Professional Service Firms: A Resource-Based Perspective. *Academy of Management Journal*, 44(1): 13-28.
- Huselid, M.A. 1995. The Impact of Human Resource Management Practices on Turnover, Productivity, and Corporate Financial Performance. *Academy of Management Journal*, 38(3): 635-672.
- Kobi, J.-M. 2002. *Personalrisikomanagement. Strategien zur Steigerung des People Value*. 2. Ed. Wiesbaden: Gabler.
- Low, J. 2000. The Value Creation Index. *Journal of Intellectual Capital*, 1(3): 252-262.

- Matthewman, J. 2006. Focus on Measurement. Chartered Institute of Personnel and Development. (Ed.). *What's the Future for Human Capital?* London: CIPD: 43-53.
- Mayo, A.J. 2001. *The Human Value of the Enterprise. Valuing People as Assets*. London: Nicholas Brealey.
- Mohr, H.-C., & Keilholz, U. 2001. *Human Capital in der Post Merger Integration*. Eine Studie von William M. Mercer. Frankfurt/Main: Mercer.
- Nash, H.H. 2003. *Value Based Accounting*.
<http://home.sprintmail.com/~humphreynash/index.htm> (called 2003-07-23).
- Pfeffer, J. 1994. *Competitive Advantage Through People. Unleashing the Power of the Work Force*. Boston: Harvard Business School Press.
- Pfeffer, J. 1995. Producing Sustainable Competitive Advantage through the Effective Management of People. *Academy of Management Executive*, 9(1): 55-69.
- Scholz, C. 2006. Human Capital in Euros and Cents. Human Capital Institute. (Ed.). *Global Talent. An Anthology of Human Capital Strategies for Today's Borderless Enterprise*. Washington, D.C.: Human Capital Institute: 243-249.
- Scholz, C., Stein, V., & Bechtel, R. 2004. *Human Capital Management. Wege aus der Unverbindlichkeit*. Munich/Unterschleissheim: Luchterhand.
- Schultz, T. 1961. Investment in Human Capital. *American Economic Review*, 51(5): 1-17.
- Stewart, G.B.III. 1991. *The Quest for Value. The EVA Management Guide*. New York: Harper Business.
- Stewart, T.A. 1997. *Intellectual Capital. The New Wealth of Organizations*. London: Nicholas Brealey.
- Strassmann, P.A. 1999. *Does Knowledge Capital Explain Market/Book Valuations?*
<http://files.strassmann.com/pubs/km/1999-9.php> (called 2003-07-24).

- Sveiby, K.-E. 2002. *Methods for Measuring Intangible Assets*.
<http://www.sveiby.com/articles/IntangibleMethods.htm> (called 2003-06-17).
- Syrett, M. 2006. Four Reflections on Developing a Human Capital Measurement Capability. Chartered Institute of Personnel and Development. (Ed.). *What's the Future for Human Capital?* London: CIPD: 54-68.
- Tobin, J. 1969. A General Equilibrium Approach to Monetary Theory. *Journal of Money, Credit, and Banking*, 1(1): 15-29.
- trendence. 2005. *trendemployer 2005*. Berlin: trendence Institut für Personalmarketing.
- Ulrich, D. 1997. *Human Resource Champions: The Next Agenda for Adding Value and Delivering Results*. Boston: Harvard Business School Press.
- Weiß, R. 2001. *Betriebliche Weiterbildung 2001 – Ergebnisse einer IW-Erhebung*. Institut der Deutschen Wirtschaft (Ed.). IW-trends 1/2003. Cologne. <http://www.iw-koeln.de/data/pdf/content/Trends01-03-2.pdf> (called 2007-13-01).
- Wimalasiri, J.S. 1995. An Examination of the Influence of Human Resource Practices, Organizational Commitment, and Job Satisfaction on Work Performance. *International Journal of Management*, 12(3): 352-363.
- Young, D. 1997. Economic Value Added. A Primer for European Managers. *European Management Journal*, 15(4): 335-343.

APPENDIX

FIGURE 1

The Shapes of the Knowledge Curves in the $f(k_i; t_i)$ -Relation

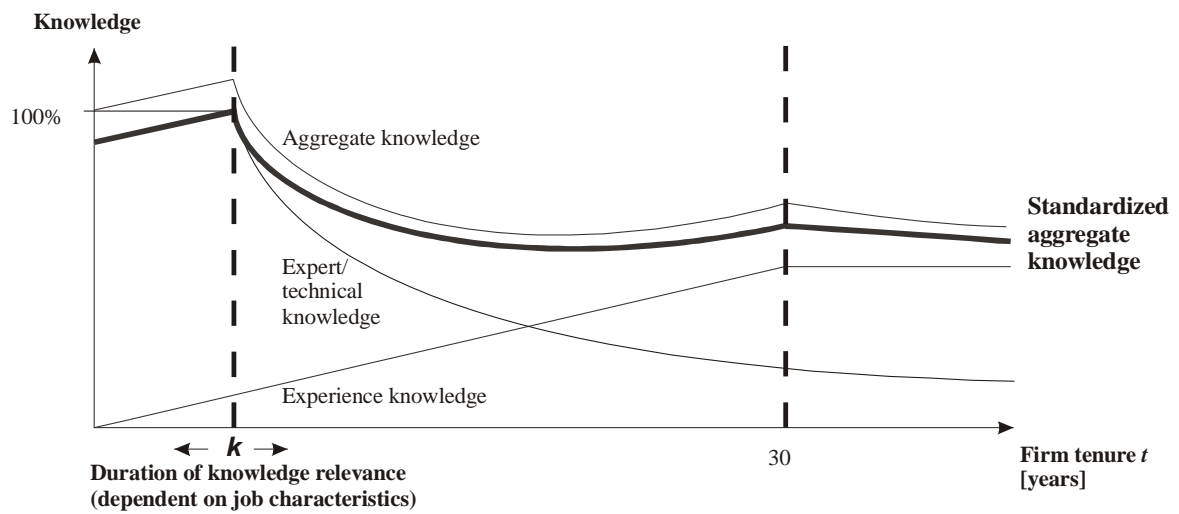


TABLE 1**Duration of Knowledge Relevance (*k*)**

Category	Requirement of Knowledge-Update	k [years]	Example
A	no	15	Waiter
B	new data	13	Office worker
C	new materials	11	Bricklayer
D	new machines	9	Toolmaker
E	new technologies	7	Electrical engineer
F	new methods	5	Tax consultant
G	new content-based knowledge	3	Natural scientist

TABLE 2
Collected Input Data on the DAX 30 Companies

	min	max	mean	s.d.
Full-time equivalents	3090.2	481475.8	127703.5	133835.2
Market salary ^a	46883.0	96265.8	71613.0	13147.4
Value base ^a	273375076.0	44749226936.6	9086008019.1	10232914703.4
Value depreciation ^a	33709568.9	14759699646.0	2170065235.4	3005056633.7
Personnel development costs ^a	3900000.0	817391401.2	250321923.9	255590553.0
Personnel development ^a	29129006.4	10203095391.6	2286176408.7	2585045763.7
Motivational value adjustment ^a	-7650726588.5	10648564969.5	427727457.5	3364651805.9
Human capital value ^a	256807576.6	42594259878.1	9629846650.0	11022250661.6
EBITDA ^a	710900000.0	20100000000.0	4551154444.4	4743782422.8
HC RoI	.838	3.627	1.766	.751
Personnel costs ^a	406100000.0	26646000000.0	6677015779.2	6757183360.5

^a values in Euro.

TABLE 3
Means, Standard Deviations, and Correlations ^a

Variable	Mean ^b	s.d. ^c	1	2	3	4	5	6
1. Value base	9,086	10,233						
2. Value depreciation	2,170	3,005	.897**					
3. Personnel development costs	250	256	.517**	.354				
4. Personnel development	2,286	2,585	.440*	.184	.950**			
5. Motivational value adjustment	427	3,364	.606**	.663**	-.081	-.219		
6. Human capital value	9,630	11,022	.972**	.806**	.582**	.526**	.635**	
7. EBITDA	4,551	4,744	.438*	.375	.383*	.308	.295	.471*

^a * p < .05
 ** p < .01
 *** p < .001. All significance tests were two-tailed.
^{b, c} values in million Euro, rounded.

TABLE 4
Means, Standard Deviations, and Correlations ^a

Variable	Mean	s.d.	1	2
1. Human capital value per FTE	0.328 ^b	0.165 ^b		
2. Human capital RoI	1.7669	.7513	-.232	
3. Personnel costs per FTE	0.0598 ^b	0.028 ^b	-.073	.144

^a * p < .05
 ** p < .01
 *** p < .001. All significance tests were two-tailed.
^b values in million Euro, rounded.