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Fink, Kerstin, "Knowledge Measurement Barriers: Results from a Case Study" (2009). *AMCIS 2009 Proceedings*. 674.
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Knowledge Measurement Barriers: Results from a Case Study

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ABSTRACT

The discussion about barriers is primarily involved with knowledge sharing issues and the implementation of knowledge management in general. The successful application of measurement strategies requires an understanding on how knowledge measurement processes are perceived by the participants. Measuring the skills and capabilities of knowledge workers is increasingly recognized as a source of competitive advantages and has to be embedded in the organizational culture. The objective of this paper is to increase the understanding of barriers associated with knowledge measurement processes. An exploratory study with 100 interviews at an European Enterprise Resource Planning (ERP) vendor was conducted to establish a knowledge measurement system and identify associated measurement barriers. The analysis of the results identified 21 measurement barriers in three categories: (1) individual, (2) organizational, (3) measurement process. It is concluded that these barriers need to be minimized to improve measurement acceptance and to support a knowledge measurement culture in organizations.

Keywords

Knowledge Measurement, Barriers, Case Study

INTRODUCTION

Over the years, research into measuring the value of company intangible assets or intellectual capital has produced many methods and theories (Contractor, 2001; Luthy, 1998; Skyrme, 1998). Knowledge measuring solutions can accelerate decision making processes, help enhance the speed of the business process, and deliver a decisive competitive advantage. If organizations want to be more successful today, they need have effective knowledge measuring systems. The success of professional knowledge organizations depends on how efficiently they can identify their knowledge potential, their knowledge workers, their critical knowledge, and their missing knowledge to locate the expertise and experience within the organization. However, measurement the effectiveness of knowledge management is not a simple task. As knowledge measuring becomes more structured and widespread, the need to establish different models and methods becomes more important. Skyrme (1998) identifies four factors that lead to pressure to measure:

- The growing irrelevance of existing measures. Organizations have recognized that intellectual assets, rather than physical assets, are the future. Traditional economic measures, such as conventional balance sheets, are not enough to establish the value of the organization.
- Growing recognition that intangible assets are more important to gain competitive advantages. The intangible assets range from brand names to the expertise of a knowledge worker.
- The focus on long-term shareholder value as a corporate goal. The shareholders want to get a better understanding of the company.
- Concerns about corporate governance. As seen in recent years, many successful companies failed due to their weakness in understanding the value of their knowledge and because they ignored the potential of intangible assets.

Based on these factors, new types of measurement systems are needed to help investors, managers, and policy-makers make decisions about the value of organization's knowledge. Also Housel and Bell (Housel & Bell, 2001) argue new metrics for knowledge assets must be developed in addition to traditional accounting and financial data. There are different groups, such

as investors, management, and customers that need metrics for the knowledge potential of a company. Without the development of knowledge metrics, this valuable resource will result in some unused assets. Companies should shift to a knowledge-value-added methodology that should help managers and executives to leverage and measure the knowledge that resides in the employees, information technology, and core processes.

Understanding how the process of knowledge measurement in perceived is important for organizations; so that barriers associated with knowledge worker evaluation can be addressed and integrated in the formulation of a knowledge strategy. The discussion about barriers is primarily concentrated on knowledge sharing barriers and knowledge management in general (Rech, Decker, Ras, Jedlitschka, & Feldmann, 2007; Riege, 2005; Sun & Scott, 2005). Riege (2005, 2007) identified 36 knowledge-sharing barriers from a literature review and categorizes these barriers into three main domains: (1) individual, (2) organizational and (3) information technology barriers. Kasi (2008) discusses possible barriers to the post mortem evaluation (PME) and identified 31 barriers in four categories (1) designing the organizational context, (2) focusing the effort and collecting the data, (3) analyzing and interpreting the data and (4) sharing and exploiting the resulting knowledge. Sun and Scott (2005) concentrate on the barriers involved with knowledge transfer, arising from the levels of learning in organizations and distinguishing individual, team, organizational and inter-organizational barrier clusters. Other authors focus rather on the identification of success factors of knowledge management. Jennex and Olfmann (Jennex & Olfmann, 2008) introduce a model of knowledge management success by considering the DeLone and McLean information system (IS) success model. The knowledge management success model differentiates into system quality, knowledge quality and service quality. However, investigations just focusing on the influence of knowledge measurement barriers are only indirectly taken into consideration.

Therefore, this article investigates barriers connected with knowledge measurement processes. The main purpose is to give a cluster of barriers associated with knowledge measurement. The case study was conducted at a large European Enterprise Resource Planning (ERP) vendor who is familiar with knowledge management initiatives and concentrates on establishing a knowledge measurement system. The large case analysis with 100 interviews covers the identification of three main barriers: (1) individual knowledge worker barriers, (2) company’s system barriers and (3) measurement process barriers. Within this context, this article elaborates some lessons learned from the implementation of knowledge measurement in an information technology (IT) company. Regarding the structure of this article, first the research framework is discussed and then the case settings with the identified three barrier clusters. Finally, besides the research limitations identified by the author, some conclusions are drawn and recommendations made by the researcher to practitioners.

RESEARCH FRAMEWORK

Figure 1 illustrates the research framework for knowledge measurement which consists of four business stages: inputs, knowledge measurement process, output and actions. This research framework assumes a set of relationships between the four stages and each previous process is determining the next one.

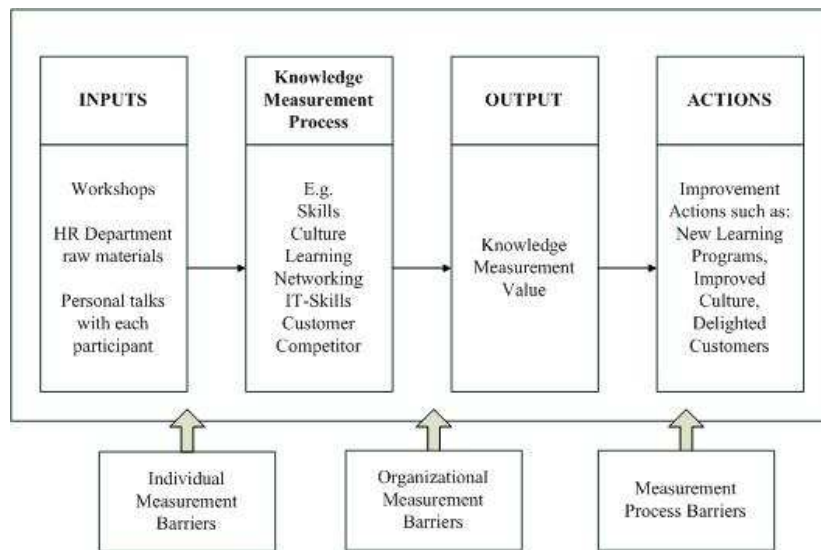


Figure 1. Research Framework

The research process started with *input information* made available by the Human Resource (HR) department with raw materials such as job description or evaluation sheets. In addition, workshops with Top Management were conducted by the author to set up a clear strategic measurement focus and an integration into the existing measurement landscape. Furthermore, personal talks were performed to prepare each participant for the measurement process by discussing the key objective and giving insight into the general purpose of the process. The second stage is the *measurement process* itself and follows the developed knowledge measurement process by the author. This called knowledge potential measurement framework by Fink (2004) was chosen to measure the potential of IT knowledge workers. The knowledge potential measurement framework by Fink (2004) follows the quantum thinking approach (Gribbin, 1999) and the framework by (Kilmann, 2001) who discusses the quantum organization as a new paradigm to manage organizational transformation in a world which is highly interconnected and where success depends whether the participants progress towards self-aware consciousness. Within the knowledge potential measurement view, the focus on people does more than imply an understanding of knowledge exchanges and relationships based on such exchanges. It also implies an understanding of how such knowledge influences the action or the potential action based on such exchanges. The knowledge potential measurement process is divided into three measurement areas:

1. *Knowledge mass* is defined as the sum of person-dependent variables that influence the knowledge potential of an expert and is determined by the following measurement variables: skills, networking, learning ability, content understanding.
2. *Knowledge velocity* is the accomplishment of problem solving objectives. In a company, there must be a general acceptance for rapid decision-making and the quick application of knowledge to the development of new products and services. Velocity is an important variable for one to understand how efficiently a company is using its knowledge capital.
3. *Knowledge position* covers all system-dependent variables for knowledge potential, variables that cannot be manipulated and changed directly by the knowledge worker. Possible measurement variables are the influence of the company culture to the working process, organizational knowledge, information about customer satisfaction or about competitor/markets, and the use of IT/knowledge management systems for handling the business.

The third stage of the research framework deals with the *output* of the knowledge potential measurement process. The result of this measurement process is the value called knowledge potential which evaluates the knowledge intensity of an expert. This value describes an expert within the three defined measurement areas and is the basic value for the fourth stage. The derived *actions* are future oriented and help the organizations as well as the expert to define actions for improvements. Example are for instance more contact with the customer to increase customer satisfaction, participation on learning courses for intensifying the personal skills or learn new required skills to perform better. Parallel to the four stages of the research framework knowledge *measurement barriers* were identified which made it at the beginning difficult to get the measurement process running. This was the motivation to cluster the barriers associated with the input-measurement-output-action framework and improving future measurement projects by taking these barriers in consideration. Case study results showed that knowing these barriers can help to improve knowledge potential measurement projects and create an atmosphere of trust for the participants.

Case Description

This case study has the objective to filter key knowledge measurement barriers. A case study (Gillham, 2000; Yin, 2009) was conducted at a large European Enterprise Resource Planning (ERP) vendor, who was very open-minded towards the issue of knowledge management in general and in particular to knowledge measurement. For Eisenhardt (1989) a case study is a research strategy which focuses on understanding the dynamics present at a special setting. In this paper the research methods of a case study was chosen to get more insights of measurement barriers. The key objectives of the case study were on one hand to investigate how the knowledge potential measurement framework is working in real-life situations and on the other hand to derive barriers associated with this measurement process. The results of the case study are reflected and evaluated according to the reflection theory of Schön (Schön, 1982). The target groups were knowledge workers (Amar, 2002) with an IT background and qualified for future Top Management position within the company. During the time of measurement, the members of the target groups are positioned as Middle Management employees. First, a two day workshop together with the company's board members in Europe, and the author was set up. The objective of the workshop was the selection of the subsidiaries with the participating knowledge workers and to clarify open questions concerning the measurement process as well as the strategic value for the organization. The selection of the subsidiaries was done by the company's board members. Austria and Switzerland was already familiar with knowledge management and volunteered from the beginning to get more

in depth information about knowledge measurement. The other three subsidiaries should be motivated to concentrate in the future to knowledge measurement and were named Hungary, Poland and Ukraine. Selection criteria of the knowledge workers were (1) suggestions for higher qualification from the department managers in the subsidiaries, (2) a minimum of five years company working time and (3) a balanced higher education training experience. This means, that most of the selected knowledge workers were participating in a MBA program for further qualification. Each subsidiary was selecting ten employees who seemed to be qualified for Top Management positions. Each selected employee had to agree to participate in the knowledge potential measurement process and also agreed upon the video taping of the interviews for further analysis and measurement improvements. The method of elite interviews was chosen because according to Gillham (2000) this kind of interviewing is to address someone in a special position or an expert.

After the management workshop, the author initiated a workshop with the fifty selected employees to give more insight into the process of measurement, the key objectives and the use of the collected data. After this workshop, each participant was familiar with the procedure and the subsidiary department managers were informed about the further steps. During the workshop the interview weeks in each of the five states were defined and a timetable for the interviews was set up. The interviews took place in spring/summer 2007 and a second measurement round was taking place in the year 2008 with the same participants. The objective of the second measurement process was to discuss the outcomes of the first knowledge potential measurement process and the further steps for the qualification for the new Top Management job. In addition, the identified knowledge measurement barriers by the author in the first measurement round were reflected and adapted to finalization.

This means, for the data sample, the author conducted 50 interviews during the first measurement round and again 50 interviews during the second measurement round. In total, 100 interviews in the ERP-vendor company have been conducted during the years 2007 and 2008 and are the data sample for exploring knowledge measurement barriers. After the first interview cycle the author extracted general perceived barriers during the 50 interviews. Then, clusters of measurement barriers in accordance to Riege (2005) have been derived. However, the cluster of information technology did not match with the measurement experiences and was substituted by the category of measurement process. This indicates that the process with the measurement setting itself affects the output of the measurement process. Finally, the three main categories are:

1. *Individual barriers* which represent those issues affected by each knowledge worker.
2. *Organizational barriers* reflect the role of system dependent variables which are inherent in the organizational structure and processes.
3. *Process measurement barriers* which have to be taken into account and are mainly focused on the interview settings and the role of the interviewer itself.

After the second measurement round 2008, the barriers have been adapted. Furthermore, the final list of barriers was discussed with all participants and the subsidiary managers as well as company managers. The results are discussed in the next section.

KNOWLEDGE MEASUREMENT BARRIERS

The factor tables represent the result list of possible knowledge measurement barriers extracted during the exploratory case study. To support the decision process of using measurement processes, factor tables have been derived. This is a table for each of the three dimensions containing seven factors describing the meaning of the dimension. In this release of the model the factors were derived from the case analysis and the reflection with the stakeholders (subsidiary managers, company managers, participants and interviewer). Each of the factors has a different impact to the intensity of each barrier. The impact is expressed in an interval ranging from VH = very high (5), H = high (4), M = medium (3), L = low (2), VL = very low (1). A catalog of criteria was developed to make the assignment to each ranking factor. This ordinal scale implies the judging of the contribution of a factor to the measurement process and is the result of the reflection process with the participating stakeholders.

Individual Barriers

Table 1 lists the seven filtered barriers on the personal level. Despite the general acceptance of knowledge measurement during the workshop, in the real-life situation the participants were reluctant to engage to answer the questions. The reason for the fear was the risk of losing the job in times of an economic crisis. Furthermore, the identification of a lack of necessary skills was leading to answer the questions in a general and broad way. The participants of Poland and Ukraine had difficulties

in articulating their answers, even if English was the company language. Finally, an interpreter was playing the role as a facilitator. Acceptance of the interview questions was more problematic were employees could see that they might be less sophisticated than the other nine competitors in the subsidiary. A key issue arising during the process was the discussion of the use of the results and who has insight to the documents. An example statement was “Is the working council informed of the measurement process and what is the guarantee that my supervisor is not receiving the results before I had the possibility to have a look on it”. In general, the agreement during the workshop and the acceptance of the real measurement process was diverse. The situation of competition established the view of trying to convince the interviewer to make good evaluations and influencing the process of scoring. Tan et al. (Tan, Pan, Lim, & Chan, 2005) point out that affective conflicts often threaten business performance and productivity.

Individual Knowledge Measurement Listing	Impact	Numeric
1. Fear of knowledge measurement process to the job (risk of job security)	VH	5
2. Fear of misuse of the collected data of being disqualified in the working team	VH	5
3. Low awareness of the benefit of knowledge measurement	H	4
4. Difficulties in articulation and demonstration of own knowledge skills, language problems	H	4
5. Fear of being lower qualified as expected by the senior management	H	4
6. Uncertainty about further actions after the measurement process	M	3
7. Comparison of the results with other colleagues	L	2
Arithmetical Mean	M	3,85

Table 1. Individual Knowledge Measurement Barriers

Organizational Barriers

Table 2 illustrates the barriers associated within the organizational context. The implementation of a knowledge management system depends highly on the corresponding corporate culture and organizational structure. If people want to transfer their experience and expertise, they need an environment that is based on trust and an atmosphere that supports the sharing of creative ideas (Davenport & Prusak, 1998).

Organizational Knowledge Measurement Listing	Impact	Numeric
1. Lack of corporate culture to integrate measurement into the business strategy	VH	5
2. Lacking support of senior management to participate in the measurement process	VH	5
3. Lack of commitment of the subsidiaries	VH	5
4. Missing strategy for further improvement actions	H	4
5. Giving not enough time for the measurement process; daily business is more important	H	4
6. Missing information systems that monitors the results and changes over time	M	3
7. Low allowance of reflection of the company’s overall performance	M	3
Arithmetical Mean	H	4,14

Table 2. Organizational Knowledge Measurement Barriers

Abell (2000) introduces a model that integrates core professional, social, organizational, and knowledge management skills that need to be balanced to achieve a successful knowledge management environment. This view implies that knowledge

management and therefore measurement requires not only people skills but also managerial, communication, social, and technical skills. A similar definition of the culture is used by Trompenaars and Hampden-Truner (1998) who define culture as a group of people concerned with problem solving processes and reconciliation dilemmas. Culture itself has three different levels. The first, and highest level, is *national culture* or regional society; the second level describes the *organizational culture*, and, finally, the *professional culture* which is focused on the knowledge of specific groups. The empirical result showed that the answer was highly dependent on national culture. Those interviewed in Austria and Switzerland believed that between 40 and 49 percent of a job is organized for individual credit and there should be time for monitoring the personal performance in order to make future improvements to self-learning and company-learning. In Hungary, Ukraine and Poland the interviewed believed that knowledge measurement is rather a waste of time. Also Möller and Svahn (2004) point out that cultural background is influencing the way of knowledge communication and is a barrier for sharing it. Through making profit on daily business level guarantees the job in the future. The successful implementation of knowledge measurement is a long-term initiative, and it must be an integral part of a company management system and even further of the information system (Fink & Ploder, 2009).

Measurement Process Barriers

Measurement Process Barrier Listing	Impact	Numeric
1. Interviewer Bias	H	4
2. Quality of "Story-telling" strategy of the participants to perform well	H	4
3. Uncertainty of measurement	M	3
4. Biased information	M	3
5. "Lonely" interviewer as a single performer; lack of facilitator skills of the interviewer	L	2
6. Use of video-taping during the face-to-face interviews	L	2
7. Missing support of the participants and the stakeholders	L	2
Arithmetical Mean	L	2,85

Table 3. Measurement Process Barriers

Measurement process barriers are listed in table 3. The limitations of any measured value involve uncertainty. Ronen (1988) states, that from a physical viewpoint, all measured values are approximate and any degree of accuracy is subject to the limitations of the Heisenberg Uncertainty Principle in the sense that uncertainty is inherent in physical processes. Therefore, it is important to keep the uncertainties of such measurements small enough that any actions based on the measurement are negligibly affected. For Cameron (1982), error analysis "can be looked upon as the methodology by which one arrives at a numerical value for the 'shadow of doubt' or uncertainty associated with his measurement. The goal is to be able to determine the uncertainty to be attached to an isolated measurement on a possibly transient phenomenon". There are three different kinds of errors (Bol'shev, 1989):

1. *Systematic errors* either overestimate or underestimate the results of measurements, and they arise for specific reasons such as the incorrect set-up of the measuring equipment. As a consequence, the measurement process is affected and altered in one direction.
2. *Gross errors* come from miscalculating the data or from the incorrect reading of the measurement equipment. This kind of error is easily to identify because the measurement result differs from other results done before.
3. *Random errors* arise from unforeseen events on the measurement. The theory of errors only is focused on the study of gross and random errors.

Maxwell and Pringle (1983) note the benefit of videotaping as a research method for very complex situations with subtle behavior changes. With respect to the knowledge measurement method, the situation is very complex for the interviewer. The quality of measurement for each knowledge worker by the interviewer is improved by videotaping because the ability to replay the interviews leads to a more accurate rating for each dimension. However, on the other side, the participants had a negative attitude towards video-taping. Before starting the measurement process, each participant had to agree that video-

taping can be used for future data analysis but after the analysis time the tapes must be send back to his personal address. Another point is that it is important that the interviews with the knowledge workers are conducted by at least two interviewers. This process helps to reduce on one hand interviewer fatigue, because the interviewer ask alternating questions and on the other hand it also minimizes respondent fatigue by receiving questions by two persons. A major interviewer skill must be in establishing a situation of trust between the knowledge workers and interviewer in order to reduce respondent bias. Only if the knowledge workers have the feeling that there is an atmosphere of well-being, they will be willing to give answers corresponding to the questions and not just telling a story in order to being evaluated on a high level. Interviewers have to be aware that when questions about sensitive topics such as giving insight of the tacit knowledge are being asked, their characteristics have a major impact on the result (Fink, 2005).

DISCUSSION AND FUTURE RESEARCH

Figure 2 summarizes the key findings of the exploratory case study. The values on the three axes are the arithmetic mean derived from the factor tables 1 to 3. The highest impacts for successful knowledge measurement are organizational barriers, followed by individual and measurement process barriers.

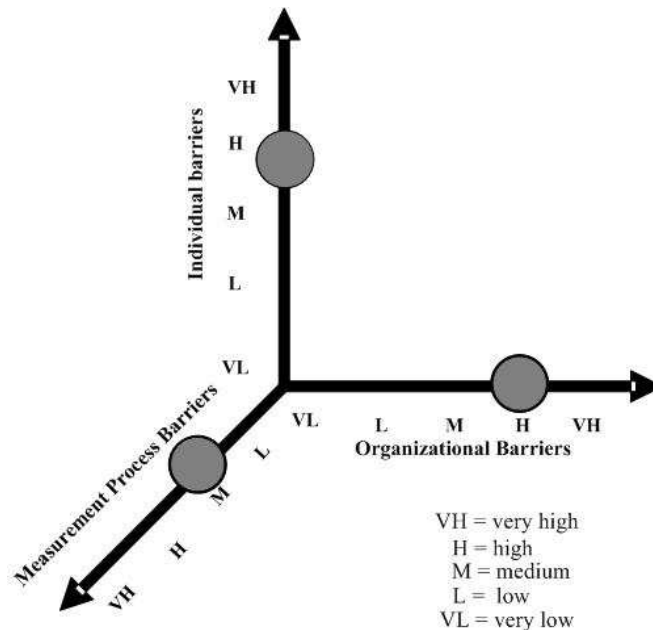


Figure 2. Knowledge Measurement Barriers

In the future, in order to evaluate the identified knowledge measurement barriers, it is planned to carry out further industry-related case studies which is a limitation of this research. Currently, there are case analyses conducted by the author in the banking sector. The objective is on one hand to test the 21 identified knowledge measurement barriers and on the other hand to adapt the list by adding new barriers not identified during the case study in the IT field. The underlying objective is to demonstrate that knowing the possible measurement barriers, can improve the results of the evaluation processes. In conclusion, adapting the existing knowledge potential measurement framework can help to overcome resistance to measurement processes in general and support organizations in introducing knowledge measurement processes. Therefore, the benefit will not only be for the company to monitor performance measure but also for the knowledge workers to trust in the results of the evaluation. This means, that all three key players of the measurement process – organizational managers, knowledge workers and interviewer – have to set up an atmosphere of trust and understanding what the impact of knowledge measurement is. Lessons learned from the case study show that the initial workshop has to focus on discussing these possible barriers and conducting a more trusted and secured area. The conducted exploratory case study also indicated that users of knowledge measurement should consider these six cornerstones of reducing measurement barriers:

1. *Recognition of all relevant stakeholders* involved in knowledge measurement processes. Parmenter (2007) discusses that the successful pursuit of performance improvement requires the partnership between anticipating groups such as managers, local employees or major customers.
2. *Linkage of knowledge measurement* to the business strategy. The development of a measurement strategy should become an iterative process and being conducted on regularly basis.
3. *Establishment of a culture* of trust and job security.
4. *Introduction of a reporting system* that explains the key measurement indicators and explains the overall process of evaluation and the use of the retrieved data.
5. Use of a *skilled external measurement expert* who has long-time skills in interviewing and is a facilitator of trust and guarantees a high quality of knowledge assurance.
6. *Commitment* of the subsidiary managers and coordination with the local managers and the headquarter.

These rather practical actions help to improve the measurement process and limit knowledge measurement barriers to a minimum size. Future research will direct into working out an action plan for overcoming knowledge measuring barriers. The increased acceptance among the participants of the case study is an indicator that knowledge measurement can improve business performance and add value to the organizational performance.

ACKNOWLEDGMENTS

My thanks belong to all participants of the knowledge potential measurement project and giving me the possibility to reflect on the process in general. The Lesson Learned process will improve future defined measurement projects.

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