When Measuring Performance Makes the Difference
Quality and Success of a Clinical Knowledge Management Project

Brigitte Stroetmann, Alena Leinfelder, Alessandro Ortisi and Okan Ekinci

Siemens AG Healthcare Sector, Allee am Röthelheimpark 3 A, Erlangen, Germany

Abstract: This paper is designed mainly to provide a picture of how the value of Knowledge Management Projects within Siemens Healthcare is assessed and analyzed. Due to the growing number of knowledge and new research areas, especially in medicine, it is essential to provide up to- date information with an impact on the healthcare business. The degree to which the organization effectively uses this information is an indicator of the organizational knowledge management maturity. The main question to be answered is "Which performance indicators should be measured when analyzing the quality and success of a knowledge management project". We reviewed available literature to validate the performance indicators that show positive outcomes of the projects. Most importantly we want to emphasize how easily these metrics can be implemented into the company's operational business. We, therefore, recommend web-based surveys and reporting tools that automatically measure and calculate the results. The information should be easy to read and enable effortless performance change monitoring.

1 INTRODUCTION

Siemens Healthcare brings together innovative imaging and laboratory diagnostic equipment, information technology, management consulting and services to help customers achieve positive and sustainable clinical and financial outcomes. The company focuses on strategies to increase both efficiencies and quality of care, while simultaneously reducing costs. Its scientists are professionals who focus on driving innovation for customer excellence. Managing knowledge has turned out to be a key to initiating successful business, as the healthcare environment is continuously changing and becoming increasingly competitive.

Thus Siemens Healthcare follows an active knowledge management strategy. As most of the employees have a scientific, technical, strategic or financial background, but not necessarily deep medical knowledge, the company decided to provide their employees with current, up-to-date medical knowledge that is of relevance for innovations in solution and product development. The clinical knowledge management approach includes the gathering, evaluation, storage and use of relevant

medical information. It is based on three pillars: the Clinical Competence Centers, a group of medical in-house experts, who give medical advice on individual questions, the Clinical Knowledge Base – a knowledge repository for disease-specific information, and finally the Siemens Healthcare Academy

By measuring the performance of activities in the Knowledge Management project it is possible to ajust the services to changing demand patterns and business strategies.

2 BASIC CONCEPTS

Knowledge Management has been around for more than 20 years and there are dozens of strategies, tools and approaches for making the most of knowledge assets in an organization. The ever rising awareness regarding the impact of successful KM strategies results from the fact that knowledge assets represent the fount of a company's competences that are deemed essential for customer satisfaction, competitive advantage and product innovation. Companies are undergoing fundamental changes as the emphasis has steadily moved from physical or

Table 1: Literature Overview.

Author	Title	Main Issue	Indicators
Bhatti et al. (2011)	The effect of knowledge management practices on organizational performance: A conceptual study	KM success via a knowledge sharing culture	process, intellectual capital, culture and strategy
Davenport et al. (1998)	Successful Knowledge Management Projects	KM project success via identifying key characteristics	economic performance, infrastructure, balanced structure, positive environment, clear purpose and terminology, motivation, multiple channels, management support
DeLone and Mc Lean (2003/1992)	The DeLone and McLean Model of Information Systems Success: A Ten-Year Update	KM success via a multidimensional and interdependent construct	system quality, information quality, use, user satisfaction, individual impact, organizational impact
Jadoon and Hasnu (2009)	Collaboration Dichotomies in Knowledge Management Success	KM success needs intra-organizational collaborations	intra-community social interactions, KM systems
Jennex et al. (2008)	Towards a consensus knowledge management success definition	definition of knowledge management success	impact on business processes, strategy, leadership, and knowledge content.
Jennex et al. (2012)	Where to look for Knowledge Management Success	KM success as a multidimensional concept	impact on business processes, strategy, leadership, and knowledge content.

tangible assets to intangible knowledge assets. This has important implications for how knowledge assets are acquired, sourced, created and utilized, and how the dissemination of knowledge and effectiveness of knowledge assets can be measured.

The literature is packed with recommendations and also controversial discussions about KM performance measurements.

A section of the literature argues strongly that the development of KM performance metrics is crucial: without metrics, knowledge cannot be produced. Without measurement, knowledge management results into a metaphysical exercise with little actionable value. Metrics are important because what gets measured gets done. According to the American Quality and Productivity Center (APQC, 2003) knowledge is an intangible asset, but the impact of KM is measurable.

Other authors doubt the value of KM performance measurement 'It is certainly possible to identify metrics … The best known of these was developed by financial services group Skandia, but there are some doubts as to whether it provides a generally portable model' (Gamble and Blackwell, 2001). Unfortunately there is no direct relationship between an intangible asset and financial outcome. Thus, financial accounting and traditional accounting instruments fail to capture these values and report them.

A review of the KM performance literature reveals that there is no certain set of performance metrics that fits all organizations and is as well recommended by the KM community.

From a knowledge perspective, "Knowledge Management success is a multidimensional concept" (Jennex, 2008) which has different interacting components. Jennex et al. measured KM success by means of the following dimensions: impact on business processes, impact on strategy, leadership, and knowledge content.

To verify these components, in 2012 Jennex et al. published the results of their KM success survey and showed that the more successful a knowledge management initiative the more the KM measured items in more dimensions. This confirms the multidimensional approach model and shows that successful knowledge managers should use multiple measurements in all four dimensions.

This multidimensional concept was adapted from De Lone and Mc Lean (2003/1992) who identified the six dimensions: system quality, information quality, use, user satisfaction, individual impact and organizational impact. Information system success is therefore a multidimensional and interdependent construct with important interrelationships. This approach is one of the basic models for KM success and was modified by many authors such as Jennex et al.

A basic approach to identifying the main objectives of KM projects was adopted by Davenport et al. (1998). They identified four main goals: create knowledge repositories, improve knowledge access, enhance knowledge environment and manage knowledge as an asset. For knowledge repositories it is necessary to capture the information and store it, for example by means of an IT system which can be easily accessed. Improving knowledge access does not only mean access to a database but also connecting knowledge holders and knowledge recipients in an effective way. This leads directly to the creation of a knowledge environment which can be turned into a core asset for an organization. To measure whether the knowledge initiatives are successful, Davenport et al. identified eight key findings such as technical and organizational infrastructure, knowledge-friendly culture, clear purpose and terminology, multiple channels for knowledge transfer, senior management support etc.

In particular the aspect of a knowledge friendly environment with the opportunity to collaborate and share knowledge is addressed by many other authors, too.

Bhatti et al. (2011) performed a literature screening, and defined KM success via a sharing culture between the employees. They therefore developed a conceptual frame work model including processes, intellectual capital, culture and strategy, called PICS, as pillars for organizational KM. For successful KM it is necessary to create a strategy which considers the whole of the knowledge a company offers and turn it into a sustainable core competency.

Jadoon and Hasnu (2009) agree with the principle of a knowledge sharing culture and also claim an IT concept focusing on intra-organizational collaborations. They were able to show that there really is a significant positive correlation between KM systems and collaboration and the resulting success.

Much has been written about KM performance measurements, but little of it provides practical methods to measure the KM state of the organization.

The challenges involved in the precise measurement of complex interrelations can be seen from the sign that hung in Albert Einstein's office in Princeton: "Not everything that can be counted counts, and not everything that counts can be counted". Subsequently we have been looking for performance indicators that may not necessarily show the improving overall organizational performance, but do show if the knowledge activity is improving / increasing or not. These determine the status of the KM project and whether it has established a level of satisfaction or if there is a need for some improvement actions (Robertson, 2003).

3 SIEMENS HEALTHCARE CLINICAL KNOWLEDGE MANAGEMENT PROJECT

In order to understand what is going to be measured, this section briefly describes the main elements of the Clinical Knowledge Management Project.

3.1 Purpose of Implementing a Clinical Knowledge Management Project

The Siemens Healthcare Sector is one of the world's largest suppliers to the healthcare industry and also a trendsetter in medical imaging, laboratory diagnostics, medical information technology and hearing aids. Siemens offers its customers products and solutions for the entire range of patient care from a single source – from prevention and early detection to diagnosis, and on to treatment and aftercare. The company focuses on intangible assets as they have a greater impact on the value of a high technology sector, such as health care, than on other sectors.

As such, the management of knowledge is paramount in the context of health care industry organization. Current medical information and knowledge are some of the core assets in the health care industry, but information overload is a real challenge. Medical knowledge has been expanding exponentially during the last two or three decades, and new areas of research, such as bionanotechnology and genetics, are growing at a tremendous pace. Moreover, most of the employees have a scientific engineering, strategic or financial background, but not necessarily deep medical expertise. Thus medical knowledge has to be actively managed.

3.2 Active Knowledge Management Approach

Siemens Healthcare takes an active approach to medical KM by executing a series of strategies to improve the way knowledge is managed.

A dedicated team of KM "workers", who are actively managing the operational KM process, co-

ordinates the basic processes of the knowledge management life-cycle. This comprises identification of medical knowledge needs, the creation and dissemination of medical information as well as storage and updating. As the expertise of most employees is related to economics, business, or technical issues, the team actively manages the timely dissemination of relevant medical information into the organization. The KM program offers three services. First, pull services (self-service) – contribute & retrieve knowledge as and when it is needed. Second, push services (facilitated transfer of knowledge) driven by the needs of the organization. And third, individual expert advice where peers and experts join forces to discuss and share knowledge.

3.2.1 Clinical Competence Center - The Central Source of Medical Knowledge

Highly regarded physicians from the fields of cardiovascular medicine, oncology and neurosciences are working closely together in the Clinical Competence Centers (CCC).

They provide in-depth medical information and educational training required to fully understand the customer's needs in various units of the company, from marketing to sales and from product definition to R&D. They also perform a regular scientific literature review, summarize and record the content of each, and provide a critical review of the major works to identify the potential impact of scientific findings on Siemens Healthcare business and put strategic decisions in marketing and product development on a sound basis.. Furthermore, the members of the Clinical Competence Centers build and maintain networks of key opinion leaders in their specialties to identify future disease trends at any early stage.

Although the physicians in the CCCs have broad practical experience in the diagnosis and treatment of diseases, standard of care evolve, clinical pathways and decision making as well as procedures change over time. . Thus, the physicians of the CCCs also practice in hospitals to keep up with medical progress and advances within their specialties.

3.2.2 the Clinical Knowledge Base - The Online Portal for Healthcare

Siemens Healthcare operates the knowledge sharing platform Clinical Knowledge Base on a Microsoft Sharepoint® 2007 Business & Collaboration Platform. It connects the 40,000 Healthcare Sector

employees worldwide and allows online exchange of up-to-date medical information. The Clinical Knowledge Base features up-to-date information, research insights, technology trends, news and reports that might be relevant to the company's current and future product development activities (Fig.1).

Every single document has been commented on and reviewed by a member of the CCCs. One of the great benefits the users of the Clinical Knowledge Base experience is the worldwide access to the information pool. The Clinical Knowledge Base offers an intuitive user interface and flexible workflow experience that supports individual problem-solving approaches. The platform also provides a space to post urgent requests via a simple web-based interface. Here, the experts of the CCCs offer support for individual projects and inquiries.

Figure 1: Clinical Knowledge Base.

3.2.3 Siemens Healthcare Academy-Life-long Learning Possibilities for Siemens Employees

Siemens Healthcare Academy is an international initiative across Healthcare. The objective is to help all Healthcare employees understand their customers' clinical workflows and, therefore, their requirements. Only those who know their customers well can offer solutions tailored to their daily work environment.

The first component was a multimedia, web-based learning program that tackled the subject of

clinical workflow. The current offering comprises clinical basics and advanced courses as well as dedicated sales training. In addition to classroom trainings, a variety of e-learning courses are available. Blended learning concepts are applied to optimally use resources. For instance a web-based training on basic cardiology is a prerequisite for more advanced classroom trainings in cardiology. Thus, the curriculum and content of both e-learning and classroom trainings are interlinked.

4 PERFORMANCE INDICATORS AND MEASUREMENT

"According to a study by APQC on measuring the impact of knowledge management, many companies simply rely on their standard performance measurement of items such as growth, profit, and new product sales to evaluate the impact of knowledge management. While these types of outcome measurements are certainly important, they are highly unlikely to be influenced solely by knowledge management activities, and therefore make poor metrics. A further problem is that these outcome measurements are all lagging indicators, and it might take several years for the sharing of knowledge to show up in a bottom line performance measurement" (Brown).

Thus we pragmatically looked at performance metrics or key performance indicators that provide a practical way to measure the activity of the KM-project and their impact. "The most important characteristic to consider when choosing or defining a way of measuring KM performance is whether the metric indicates if knowledge is being shared and used" (Hoss and Schlussel, 2009). Also, good metrics are reliable, repeatable, easy to use and consistent. "When a content management system is in place, a suitable metric could be the number of documents downloaded from the repository. While this is a numeric metric, metrics can also be qualitative, e.g. improved employee satisfaction.

The performance of the project is measured in active involvement. Examples of indicators used are the number of participating employees; the number of requests and postings as well as the number of downloads from the Clinical Knowledge Base. Other measurements include end-user satisfaction with support from the experts of the Clinical Competence Centers, and end-user satisfaction with the cooperation with the Knowledge Management Team.

4.1 Automate Measurement-Webtrends as Reporting Tool

When possible and reasonable, we tried to build the performance metrics into the design of the Clinical Knowledge Base itself; thus the metrics are automatically generated during normal usage of the Knowledge Base. Some years ago Siemens Sector Healthcare introduced "webtrends" software solution offerings to continuously measure web traffic on the intranet, and also to analyze and assess its website.

Webtrends describes the use of its Digital Measurement Solutions in the following way: It enables brands to justify investments and prove marketing success across new and emerging channels. By creating a culture of measurement, actions become informed by digital intelligence, not by guesswork (Webtrends, 2013).
Used by hundreds of enterprises worldwide, Webtrends provides a comprehensive, SharePoint-specific solution that can help improve content, usability, search and collaboration (Webtrends, 2013).
To paraphrase, this program helps to visualize the data that drives your business and as a result identify new areas for improvement in a scientific approach. Of course it is also a basic tool for key figures which have to be reported for quality management requirements.

Within webtrends, a special profile for the Clinical Knowledge Base has been created to measure key metrics and analyze its benefit for the users. Each page of the Clinical Knowledgebase executes some JavaScript code on loading to collect data of the current page, the referring page and the user environment. In addition a "Tracking Pixel" is requested from the central Webtrends Service. To comply with the Siemens Privacy Guidelines and Statements, all personal and private data is stripped and the results are sent back to the central Webtrends Service. The dashboard included for example the following metrics (Fig.2).

The measurements are conducted on a monthly basis. In addition, the number of user requests is assessed and analyzed in the "Knowledge Activity Report" (Fig.3).

4.2 Ongoing Evaluation of Research Requests and Expert Advice Services

As mentioned earlier, each user can ask for individual medical expert advice or ask for a
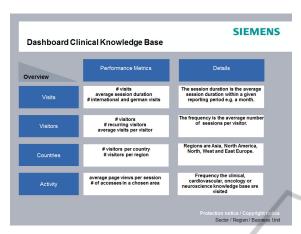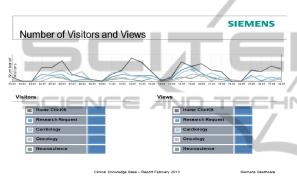
Figure 2: Dashboard Clinical Knowledge Base.

Figure 3: Knowledge Activity Report.

Figure 4: User Satisfaction Survey.

dedicated study. This can be done online in the Clinical Knowledge Base via Infopath, a web form application in sharepoint. The discussions are documented along with scientific papers and final expert advice. These requests are monitored based on criteria like department, the requester's country of origin, field of interest e.g. cardiology, oncology.

Finally there is the end-user satisfaction survey in the middle of the year.

4.3 End-user Satisfaction Survey via Sharepoint

The end-user / employee satisfaction survey is also realized in the sharepoint environment. The online employee satisfaction survey is a very effective way to identify and diagnose the usefulness of the information and services provided. Also, it provides insight into upcoming new information needs.

The survey comprises overall dimension rating questions as well as ratings by provided information areas (Fig.4). Examples of overall rating questions are "How satisfied have you been with the response time?" and "How satisfied have you been with the
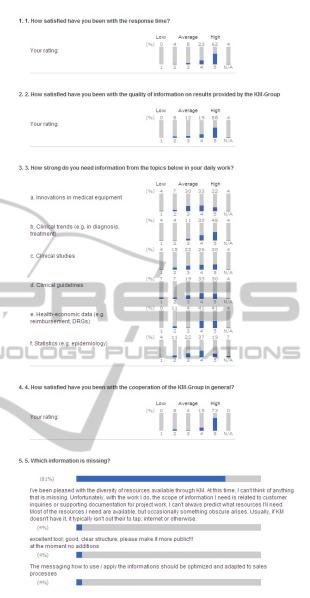
quality of information provided by the KM group?". The answers are rated on a five-point scale from Excellent, Good, Average, Fair to Poor. Sample questions concerning the content provided are "How strongly do you need information from the topics below in your daily work: innovations in medical equipment? Clinical trends, statistics?".

The free-text comment field is also very valuable as the user can comment in a text box on what information is missing or things to improve. Based on this feedback, knowledge gaps are identified, future knowledge demands are identified and the service offerings can be further developed and optimized. This process leads to the constant

improvement of the available medical knowledge and its dissemination.

5 CONCLUSIONS

KM as a whole is a complex process, which requires more than an optimal information and communication infrastructure. "The success of KM initiatives depends equally on the active involvement of everyone throughout the organization, as well as on their consistency with the organization's broader business strategy and culture" (Ergazakis, 2005).

Siemens Healthcare Clinical Knowledge Management Project is continuously reviewed, assessed and analyzed to identify the quality of its knowledge assets and resources. At a more detailed level, the company's information system, its processes and its knowledge enabling technology is examined.

For many years, Siemens has followed a KM with clear objectives and approaches and enjoyed strong commitment from top management.

Since 2001, Siemens has been among the best finalists in MAKE, the European Most Admired Knowledge Enterprises ranking, which is conducted annually by the UK-based consulting firm Teleos. In 2010, the organization achieved first place for the third time (2003, 2004, 2010).

The Siemens Healthcare Academy, the Clinical Competence Centers, as well as Clinical Knowledge Base of Siemens Healthcare are a constructive example of the company's successful KM and education strategy. The organizational benefit of the Siemens Healthcare Clinical Knowledge Management concept is the improved operational efficiency of finding relevant information when needed and greater confidence in the quality and relevance of that information.

The whole point of KM is to make sure that the knowledge available in an organization is applied productively for the benefit of the organization.

REFERENCES

American Productivity and Quality Center (APQC), 2003. *Measuring the Impact of Knowledge Management.* In Best Practices Report.

Bhatti, W.A., Zaheer, A., Rehman, K.U., 2011. *The effect of knowledge management practices on organizational performance: A conceptual study.* African Journal of Business Management, Vol.5 (7), pp. 2847- 2853.

Bose, R., 2003. *Knowledge Management- enabled health care management systems: capabilities, infrastructure, and decision- support.* Expert Systems with Applications, Vol. 24, pp.59- 71.

Brown, G., *Knowledge Management Metrics.* http://www.ispi.org/archives/resources/KnowledgeMa nagementMetrics_Brown.pdf.

Davenport, T.H., De Long, D.W., Beers, M.C., 1998. *Successful Knowledge Management Projects.* Sloan Management Review, pp. 43-57.

DeLone, W.H., McLean, E.R., 2003/1992. *The DeLone and McLean model of information systems success: A Ten- Year Update.* Journal of Management Information Systems, Vol.19, No.4, pp. 9-30.

Ergazakis, K. 2005 *Knowledge Management in Enterprises: a research agenda.* Intelligent Systems in Accounting, Finance and Management, Vol.13, pp. 17-26.

Gamble, P.R., Blackwell, J. 2001, *Knowledge Management- A state of the art guide.* British Library, p. 203.

Hoss R., Schlussel, A., 2009. *How do you measure the Knowledge Management Maturity of your Organization? Metrics that assess an Organization's KM State.*

Jadoon, I.K., Hasnu, S.A.F., 2009. *Collaboration Dichotomies in Knowledge Management Success.* Journal of Knowledge Management Practice, Vol. 10 No. 4.

Jennex, M.E., Smolnik, S., Croasdell, D., 2008. *Towards a consensus knowledge management success definition.* In Strategies for Knowledge Management Success, Information Science Reference.

Jennex, M.E., Smolnik, S., Croasdell, D., 2012. *Where to look for knowledge management success.* IEEE, pp.3969- 3978.

Metaxiotis, K., 2006. in Schwartz, D. G. *Healthcare Knowledge Management.* Encyclopedia of Knowledge Management, pp.204-210.

Robertson, J., 2003. *Metrics for Knowledge Management and Content Management.* www.steptwo.com.au/ papers/kmc_metrics/index.html.

Webtrends, 2013. http://webtrends.com/products/analytics and http://webtrends.com/products/integration/ sharepoint/.