Information and Communication Technology Architecture Models for the Service Level Management

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ABSTRACT

Supporting business processes through knowledge management technologies is one of the key factors in the today's industry. Different business processes and the potentials of supporting them need knowledge management measures. We illustrate the applicability and possibilities of knowledge management in business processes especial in the field of incident management requiring tools and measures to assist service support processes.

Keywords

Service support, business processes, knowledge management, QPM, metric table, knowledge tools

1.0 INTRODUCTION

Customer call centers constitutes a set of resources (personnel, computers, telecom-munication equipment) which enable the delivery of services via the telephone, email or web portal access. Most call centers support Interactive Voice Response (IVR) units including the possibilities of interactions. A current trend is the extension of a call center into a contact center. The latter is a call center in which the traditional phone service is enhanced by some additional multimedia customer contact channels like fax, chat and web portal access. There already exist several academic surveys on call centers. (Pinedo, 1999) describes basics of call center management, including some analytical models. (Anupindi & Smythe, 1997) introduce the technology that enables current and plausibly future call centers. (Grossman, 1999) and (Mehrotra, 1997) both short overviews of some OR challenges in call center research and practice and (Anton, 2000) provides a managerial survey of the past, present and future of customer contact centers. Our survey deals with call centers having a help desk functionality providing different agents characterize low-skilled, highly-trained, single and multi-skilled agents via web portal access.

2.0 KNOWLEDGE MANAGEMENT ARCHITECTURE

In the literature about KM, different approaches are described how knowledge management can be supported with information and communication (ICT) systems. E.g. KM can be understood as knowledge engineering as 'business process modeling' or KM might follow a 'system approach' (Petkoff, 1997). Depending on, which approach is chosen, different ICT architectural models will result out of it. What we outline is to describe two of those general possibilities how a generic KM architecture resp. KM framework from an ICT perspective can look like.

2.1 Business Process-oriented KM Approach

The first suggestion of a KM architecture can be characterized as the architectural design consequence of a KM approach that focuses on certain business processes. According to this approach, (single) business processes should be supported with knowledge management and related activities. A main goal of this KM approach is to provide a business process with the relevant knowledge that is needed to perform the business process as good as possible. This KM approach stands in the tradition of information management as well as business process reengineering (BPR). Another characteristic of this approach is, that it mainly focuses on already existing, explicit knowledge. It is obvious, that this KM approach requires an existing business process to be put into practice. The process-oriented KM approach in particular seems to make sense and therefore can be used for well-structured and linear business processes. E.g., the KM strategy of the ERP vendor SAP follows this KM approach.

Central within the process-oriented functional architecture model is the layer of business processes. Each business process has to be provided with the relevant knowledge. Knowledge only then is useful, if it can be applied within the business process and its tasks that have to be executed. The knowledge should be structured to support the business process (e.g. product information, customer information). Knowledge flows within and between business processes have to be designed adequately. On the level of the knowledge base, knowledge processes have to be organized. This requires the establishment of certain roles (e.g. web master, content manager).

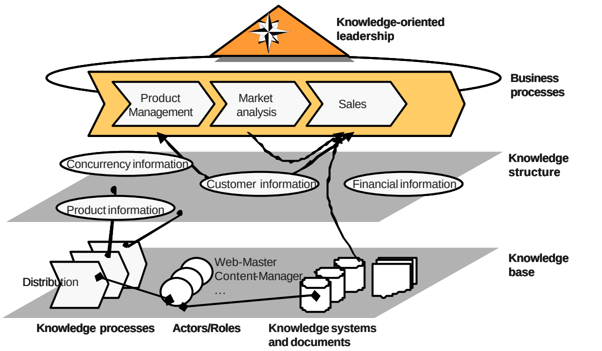

Figure 1: Architectural framework for process-oriented KM approach

People as actors are also part of the knowledge base, since they act as ‚carriers' of implicit knowledge. Traditional leadership is complemented with knowledge-oriented leadership within this architecture model, which also implicates the usage of new measures (e.g. the balanced scorecard) (Holland, 2004).

2.2 Network-oriented KM Approach

The next architecture possibility follows the paradigm of the network-oriented business and KM approach. In the center of this approach stands the network (and not primarily a business process) which simplified can be defined as a number of people and their relationship (e.g. based on a common characteristic). The main goal of the network-oriented KM-approach it is to provide a network or a network-like structure (team, community, project task force, knowledge network) with an appropriate knowledge management environment in order to increase and maintain the performance of networks. The network-oriented KM ap-proach can be used for linear business processes as well as the support of network-oriented work. A certain business process is not necessarily required (in many business areas there often exists no such structured business process!). Rather, this approach also can be used in areas of less-structured, non-linear work or also to link different business processes or business units with each other (think of communities of practice as an example). It is important to recognize, that the Network KM approach is people-oriented. Furthermore and in contrast to the process-oriented KM approach, the network KM approach also includes the creation of new knowledge. The network-oriented KM approach is a primarily people-oriented approach. What has to be supported by the network-oriented KM architecture model is in the first place the network itself and the people involved in the network. Each network has to fulfill certain functions or tasks. To execute this functions and/or tasks a network and its members have to be provided with the relevant knowledge. The knowledge demand might be induced by a business process (like it is in the business process-oriented KM approach), but there might also exist other reasons for the demand of knowledge.

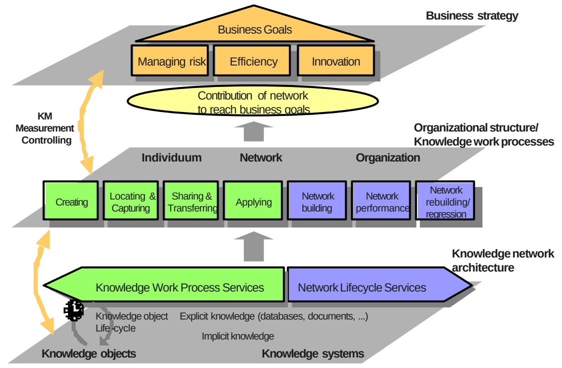

Figure 2: Architectural framework for network-oriented KM approach

The suggested network architecture model in figure 2 includes a strategic layer. We distinguish three basic business strategies: managing risk, improving efficiency and increase innovation. Each network supports directly or indirectly one ore more of these business goals. The suggested network architecture model – which is a generic model – can be used to derive more specific reference architecture models for the support of each business goal. E.g. a network to support the business goal innovation has to be configured in another way as a network to support the business goals efficiency or risk management. To control the success/contribution of a network to reach the business goals, some kind of KM measurement also has to be part of the network-oriented architecture model. It is important to recognize, that a network does not only work with already existing knowledge. An important element of the network KM approach is, to support all knowledge work processes with so called knowledge work process services.

A second category of services are called network lifecycle services that support the lifecycle of a network. E.g. those services have to provide check-in/check-out mechanisms for the network members. Collaborative tools and functions are important for network building, and so forth. Additional services might be services to control the network and also to visualize the network.

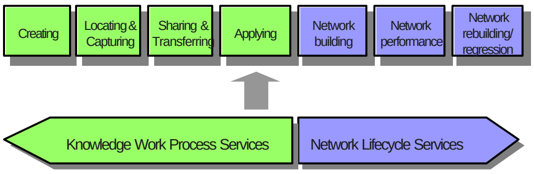

Figure 3: Services of the network-oriented KM approach

A network should not act isolated from the rest of the organization. That's why the support through a knowledge network architecture has to address individuals as network members, the network itself and the surrounding organization with appropriate services. To enable knowledge exchange between the different organizational levels, the architecture provides different work spaces for individual, network and organizational level. A necessary knowledge base as part of the knowledge network architecture layer provides access to all kinds of knowledge objects as well as to knowledge systems. It is important to recognize, that those knowledge objects are not static, but rather dynamic. This means that each knowledge object, starting with its creation goes through a certain knowledge object life-cycle in which it has a specific, well defined state at every moment. This has to be considered when designing and implementing a knowledge network architecture.
The knowledge base within a (enterprise-wide) KM architecture includes and integrates all kinds of explicit as well as pointers to implicit sources of knowledge and also different types of knowledge systems (e.g. ERP systems, groupware systems).

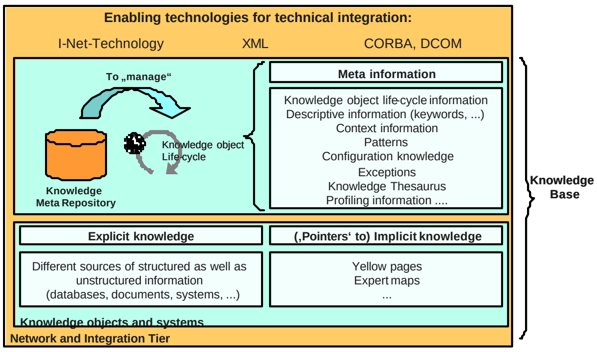

Figure 4: Knowledge base as KM meta repository

A main implication of KM on the data tier is increased use of meta information. In KM, meta-data e.g. is used to categorize, define, and describe other data. Examples are maps and data to unify the access to disparate data sources (GartnerGroup 1999a).

Meta-information also helps to
- manage the ‚dynamic' knowledge object lifecycle
- deal with different contexts of knowledge,
- reuse knowledge through the use of patterns,
- configure knowledge for different application purposes,
- handle exceptions
- establish knowledge taxonomies,
- build profile-based applications (e.g. knowledge portals, CRM).

The next figure 5 shows some aspects how the suggested functional network-oriented KM architecture model can technically be realized. The suggested technical architecture model is realized as a typical 3-tier-architecture (without the network and integration tier). The background for this architecture is represented by the network and integration tier. Today, open and standardized I-Net-Technologies are the mostly used tech-nologies to realize enterprise-wide or world-wide accessible applications. An intranet as the existing ICT infrastructure in a company can be used to build on it the suggested technical architecture. Concerning integration, I-Net technologies help to realize a consistent KM architecture. It is very probable that among others XML play an important and central role to integrate the different architectural tiers. An important part of the data tier is the knowledge meta repository in which information about the different information sources is stored. The knowledge meta repository among others helps to manage the life-cycle of the different knowledge objects. On the server tier, the knowledge work process services and the network lifecycle services have to be provided by one integrated product or several appropriate products.

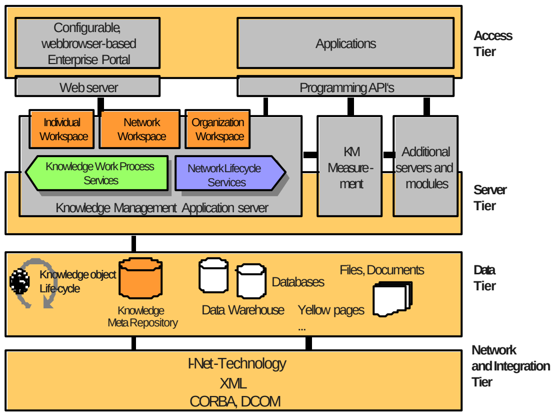

Figure 5: Semitechnical KM model including the tier-architecture

E.g. the knowledge work process services can be covered by a ‚knowledge management suite'. The network lifecycle services e.g. can be implemented with collaborative community software. The Knowledge Management application server should offer different workspaces for the individual network members, the network and the organization. KM measurement also can be realized on the server tier (e.g. as implementation of a balanced scorecard). For the access tier, the suggested technical architecture model recommends the usage of portal technology to realize a single point of access to different knowledge objects (Holland & Fathi, 2006) and also to different applications. This portal solution should be configurable to meet the needs of differ-ent networks and its members. Configuration should be possible on the individual level and on the network level too. E.g. it should be possible to configure the portal for a network that is primarily an ‚innovation network‘.

3.0 KNOWLEDGE NETWORK MEASUREMENTS

The purpose of the knowledge measuring systems like scorecards (Holland, 2004) is to measure the impact of the knowledge network on the achievement of the business goals risk reduction, efficiency and innovation. Based on performance indicators we are developing a measurement model that brings theses measures into a coherent framework explicitely in the field of business support processes (Andersson & Bider & Perjons, 2005). The following figure gives some examples of possible measures according to the aimed business goal.

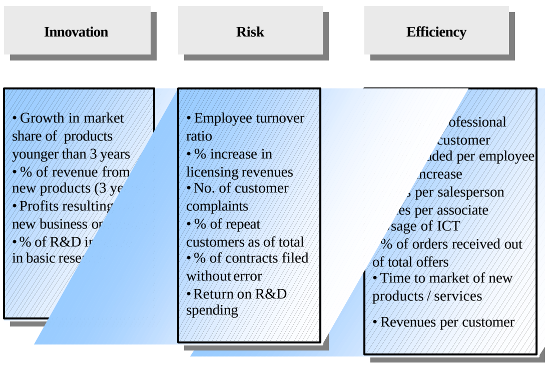

Figure 6: Example of business measurements

Performance measures should have a certain set of characteristics. It is very important to have cause and effect relationships. Every measure selected should be part of a chain of cause and effect relationships that represent the strategy. It is also very important to identify the performance drivers. Measures common to most companies within an industry are known as lag indicators (Koole & Mandelbaum, 2002). Examples include market share or customer retention. The drivers of performance (lead indicators) tend to be unique because they reflect what is different about the strategy. A good measurement system should have a mix of lead and lag indicators (Grütter, 2005). Performance indicators help determine how something is achieved, and should be particular, context-dependent measurements, self defined by the networks. They should also be simple, understandable and use existing systems and processes rather than introducing artificiality or unnecessary complexity (Thiadens, 2005). They furthermore create a language for a shared understanding of local activities throughout the company, which is very important. A challenge, that has to be dealt with is that they also influence and shape behavior. Finally the measures should be linked to financials. With the proliferation of change programs underway in most organizations today, it is easy to become preoccupied with a goal such as quality, customer satisfaction or innovation. While these goals are frequently strategic, they also must translate into measures that are ultimately linked to financial indicators. Still, with performance indicators for intellectual capital, direction is more important than precision, since essentially approximations are valued. In order to have a successful measurement system, one should follow certain steps. Firstly, it is important to develop a greater *awareness and understanding* of the role of knowledge and the nature of intellectual capital. Secondly, the creation of a *common language* that is more widely diffused within their company is necessary, e.g. using terms such as human capital. In addition to this, it is essential to identify *indicators* that are suitable and appropriate and to develop a *measurement model*, that brings these indicators into a coherent framework. Finally, one should introduce *measurement systems*, including the accompanying management processes (Maier & Remus, 2003) that guide and reward managers and maybe use objective impartial consultants and surveys to carry out key aspects of the measurement process.

3.1 Incident Management and QPM's for Knowledge Processes

Incident Managements goal is to minimize the adverse impact of technology problems on business operations, ensuring that the highest levels of service quality and availability are maintained. One way that supports this process is by bringing together management data from across the infrastructure and giving IT a single place to find and fix problems (Zhao & Liu, 2005). We will consider the call flow occurring in customer support centers. Generally, end-users have two alternatives to place a call when they have hardware or software problems: phone in calls and calls opened in the electronical support center. The standard way is via phone-in calls. In this case, a call is logged in the call coordination and based upon the problem description and the contract type, it will be routed to the adequate support team, which is the firstline - also called first Team - or the backline where the product teams work. The firstline represents the 1st level support and tries to solve most of the standard product requests by using knowledge databases. If a problem cannot be solved this way, the firstline assigns the call to the 2nd level support, the backline/product teams by adding some pre-qualified information to the call documentation. The backline/product teams who are experts in their fields, provide 2nd level support and are responsible for the final problem resolution. Furthermore, it is up to the 2nd level support to enter new knowledge data to the knowledge tools (e.g. BMC). If calls still can not be resolved on the backline level, an escalation takes place and the call with the problem definition will be handed over to the escalation team - a team which is responsible for solving very difficult and exceptional problems - or even to divisions. In comparison to phone-in calls, customers can access electronic support centers which is established via the Internet. In the ESC, the end-customer has two choices. He can place a call with the software call manager and the call is then directly routed without any pre-qualification to the support center and assigned to the backline support. With access to knowledge databases we differentiate different user groups. Typical users have access to the structured and transferred knowledge by using the user interface, providing feedback about the content structure, quality and the accuracy of knowledge. A domain architect is a supervisor or an experienced backline engineer as product specialist. He is responsible for creating, structuring and updating content regarding technical correctness and actuality. When knowledge should be shared and transferred, supervisors should make it available for all by placing the knowledge in the knowledge base (Jablonski & Horn & Schlundt, 2001) as motivated in figure 4. Supervisors should also coordinating inputs for contents, designing knowledge trees in the knowledge base and reviewing and responding to feedback. A knowledge creation process owner takes care of the whole knowledge sharing and transferring process. The responsibilities are monitoring the content generating and knowledge sharing / transferring process, identifying and solving problems regarding knowledge tools, knowledge processes and resources, acting as supervisor and communication.

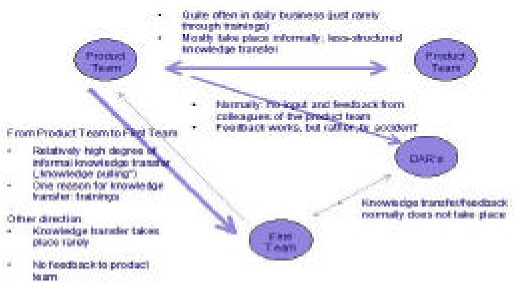

Figure 7: Amount and directions of knowledge activities within customer support centers

We will next introduce a QPM metric approach to measure QPM's for knowledge creation and maintaining, management and knowledge tools in the context of customer support process flows illustrated between the involved users. Tasks can be separated in typical clusters as shown in table 1 next:

Table 1: QPM tasks for knowledge processes.

Education
Training, User
Training, Author
Knowledge usage
Knowledge usage externally
Knowedge usage internally
Knowledge content increase
Provide human resources for Knowledge creation
Content generation progress
Knowledge accuracy
External customer (ESC) satisfaction
Internal customer (1st) satisfaction
Quality of ongoing maintenance
Regular feedback sessions with firstline/backline/DAR regarding tools
Review and maintenance of Knowledge tree structure
Review of knowledge documents
Review of feedback to nodes
Close feedback loop (first/backline) about knowledge
Knowledge Tool Availability
Provide IT supported tools and environment
Tool enhancements
High availability of tools
Provide a portfolio of tools for knowledge creation and maintaining
Regular feedback sessions with firstline/backline/DAR regarding tools
Provide functional and stable runtime environment
Other and not used for sponser review
Advertisement for local tools
Advertisement for services and processes ESC

Measureable QPM's with matrix values within the range from no influence to direct high influence can ranked based on determined goal values by the following list in table 2:

Table 2: QPM's for knowledge processes.

% trained users of to be trained users (first)
% trained authors (DAR)
of scheduled author trainings
of scheduled user trainings
of new nodes per knowledge domain
% of nodes up-to-date and accurate (not expired, no pending feedback)
ESC: # of total ESC knowledge trees user sessions
ESC Knowledge Trees traffic
ESC: # of Customer feedback in ESC related to user sessions
of new First feedback items given
Pre-qualified calls in backline related to total calls in backline
Decrease of invested time to solve
Total count of feedback items
Time to implement bugfixes and tool-enhancements

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