The Changing Role of Knowledge in Companies: How to Improve Business Performance Through Knowledge

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Abstract: Knowledge is widely accepted as strategic resource in companies, but its developmental potential is often not well exploited. Amongst others this is caused by the wide variety of knowledge management concepts, methods and tools challenging company management in selecting the appropriate measure for the specific company situation and developmental goal. Furthermore, knowledge is directly linked to people and knowledge-based interventions therefore cannot be successful without reaching the company's employees and getting them involved in any change processes. Against this background the paper discusses the changing role of knowledge in companies and investigates how knowledge-based change processes in companies need to be launched and run. Based upon this a methodological framework is proposed in order to help companies in identifying their needs for change and purposefully intervening in their processes and eventually to lend them a hand in managing their human resources, selecting technology or changing the organisation. Conclusions open up the view towards future research still required for achieving the goal of methodologically grounded managerial support and guidelines on how to best intervene in company knowledge.

Keywords: change processes, knowledge-based development, knowledge management maturity, sensitivity modelling

1. Introduction

Nowadays economic survival is vital. For that companies or organizations need to have one of three assets: knowledge, cheap labour, natural resources. Out of these three, knowledge is with no doubt the only one that can be maintained in the long run. Therefore knowledge is the source for competitive advantage in the long run. It is a key resource and crucial field of investment in today's business organisations. However, companies and organizations have a massive difficulty to account and evaluate their investment in knowledge (Meritum, 2002; Bornemann and Alwert, 2007). In particular, problems in strategically and effectively using this resource consist in: (i) how to specify, summarize, visualize the current state of knowledge; (ii) how to comfortably provide access to scattered and ill-structured information on the current state of knowledge; (iii) how to define, understand, visualize the impact of knowledge on organizational performance; (iv) how to assess and evaluate strategies and activities for purposefully intervening in organizations by means of knowledge.

Furthermore knowledge is not a static resource, but knowledge dynamics is the more important side of the analysis (Kianto, 2008). This happens because not only the economic environment is changing very fast nowadays due to globalisation, but also because investment is by itself linked to change and to dynamics. Especially, the question of how to best make use of knowledge as a resource still remains insufficiently answered. To overcome this, knowledge management (KM) needs to be seen as a supporting service addressing a company's personnel, organisation and IT basis at the same time. Any knowledge management activity and investment into knowledge must aim to purposefully intervene in a company's business processes. For this, companies require comprehensive knowledge and in-depth understanding on how to implement KM methods in a customized way. In order to provide companies with respective information and eventually lend them a hand in managing their human resources, selecting technology or changing the organisational structure, the role of knowledge in business organisations needs to be investigated and assessed further.

Against this background the paper discusses requirements for and structure of knowledge-based change processes in general (Section 2), reviews related works with regard to concepts and theories (Section 3), defines the background of knowledge-based change processes and companies (Section 4) and presents the methodological framework for unlocking developmental potential of knowledge (Section 5). Conceptual discussions are completed by a summary and concluding remarks in Section 6 which also open up the view towards future research still required for achieving the goal of methodologically grounded managerial support and guidelines on how to best intervene in company knowledge.

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2. Knowledge-based change processes

We base our research on the general assumption that there are direct and indirect interactions between knowledge, economic growth and social well-being which can be investigated at two different levels (see Figure 1).

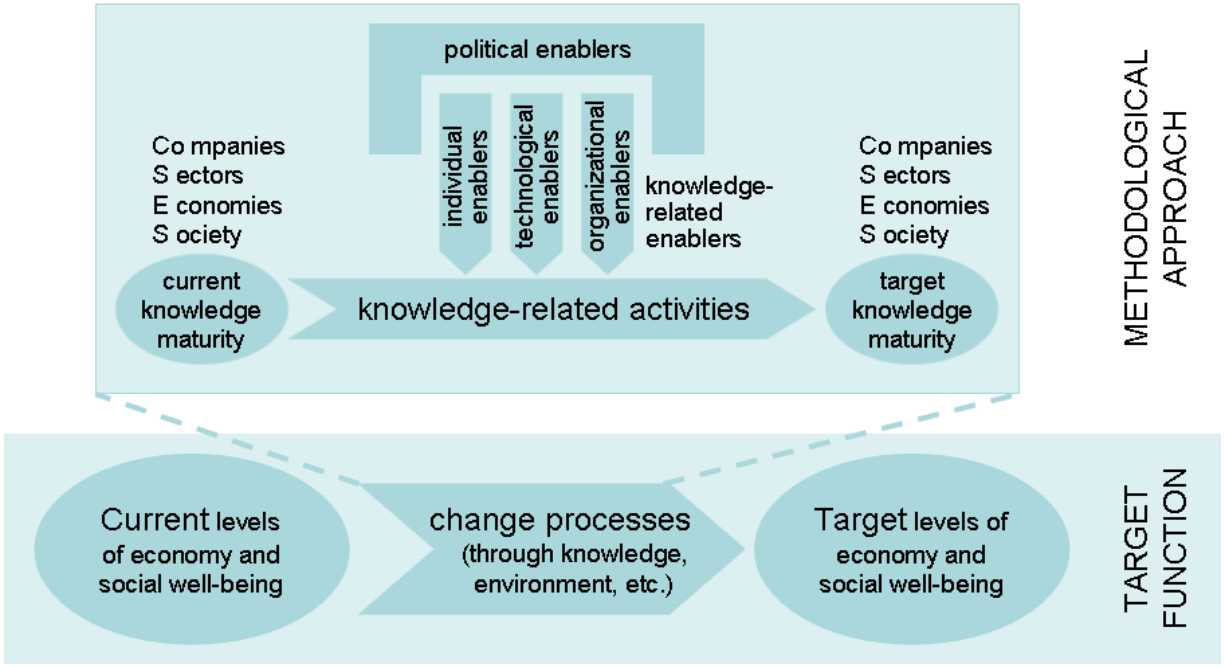

Figure 1: Knowledge as enablers in change processes

Concerning the levels of economy or social well-being any development comes from change processes the drivers of which can be knowledge, but also other societal influences like environment protection or certain technological advancements. Although those change processes are of complex nature with several drivers being active at the same time we focus on identifying, describing and investigating those change process that are initiated and driven by knowledge. Consequently, the specification on how to achieve a certain development from a current level of economy or social well-being to a particular target level of economy and social well-being through a knowledge-related change process forms the target function. For solving this target function and purposefully interacting through knowledge, it is necessary to understand how those knowledge-related change processes have to be designed.

In general, knowledge-related change processes consist of a series of knowledge-related activities that contribute to transferring a current knowledge maturity to a target one. Those activities directly depend on a set of knowledge-related enablers covering the three dimensions of knowledge management, i.e. individual, technological and organisational aspects. Those enablers again are influenced by a number of political enablers which form the general framework for a successful intervention through knowledge. Therefore, the methodological approach of the research foresees the specification of suitable sets of knowledge-maturity indicators. Furthermore, valid impact models are needed to run systematic simulations for understanding the impact of knowledge on company performance on one hand and for deriving guidelines on what kind of action should be made in order to support further development of the knowledge maturity of a company.

With this, understanding of the changing role of knowledge in relation to growth, employment and competitiveness as well as the implications of different types of knowledge for the economy should significantly be improved. Based upon this, case-based and company-specific assessment of the potential value of a certain investment into knowledge and for deriving specific suggestions and recommendations for increasing the company's level of knowledge management maturity should become possible. Furthermore, the development of quantitative and qualitative methodological approaches is promoted and the formulation and implementation of relevant policies for the knowledge market are supported.

3. Related works

3.1 Concepts

Knowledge is not an easy scientific concept even if science revolves around it. In our opinion it is important to distinguish between data, information and knowledge, meaning that information is organized data and knowledge is understood information (Maurer 1998). As a consequence, both information and knowledge require the intervention of economic agents, and are valuable economically. Also as a consequence information and knowledge should be evaluated and accounted for because they have an immense potential impact in the companies' value (Edvinson and Malone 1997). In this context it was well understood that the cycle of knowledge should be studied (Nonaka and Takeuchi 1995). However, all the previous analysis is very much linked to management, or even accountancy. And, when we analyse knowledge we have to confront and solve economic problems. Knowledge has to be seen as a resource; it has to be seen as a stock for which there is investment, from which results derive and about which there is a market.

A market is a place, virtual or local in which transactions take place. Goods and services have markets; sob knowledge must have a market also. In our opinion if we want to analyse the situation about knowledge correctly, it is not only necessary to define the level of the asset, but also to scrutinize the elements of its market namely supply, demand, equilibrium, price, quantity, need, main agents, role of the State, investment, stock, flow and returns. On what concerns the returns basic economic theory would say that the most important outcomes are wages and employment for workers, profits, productivity for companies, exports and income for countries and regions (Becker 1993, Ashton and Green 1996). We may admit that the augmentation of knowledge is itself a return of the investment in knowledge. However, recent studies assume that it is impossible to define the effect precise knowledge has in organizations, and therefore "knowledge productivity" has to be defined as the volume of innovation that is derived from the investment in knowledge, that innovation being divided in incremental innovation or radical innovation (Stam 2007): It is in this context that change may be addressed, because change may result from innovation and therefore may be considered as a return from the investment in knowledge.

3.2 Theories

The Economic theories on knowledge state some very basic ideas about the knowledge market, namely the following:

- A market on knowledge exists in which individuals and organizations sell and buy knowledge.
- Individuals and private entities should invest if they derive a positive outcome from that investment (Becker 1993).
- However, the public intervention in the market is also defendable because of market imperfections and equity reasons (Tomé 2004).
- Most of the analysis is made for companies but in a regional or macroeconomic scope knowledge is assumed to have positive influences that should imply public policies (Bonfour and Edvinson 2005).
- The market of knowledge may be competitive, but some authors have recently suggested that imperfect competition and oligopoly exist. This lack of competitiveness would be a consequence of increasing returns to scale in the knowledge investment (Stam 2010).
- The analysis of the economic effects of knowledge is usually perceived in a static way but "comparative static".
- However it is also important to put the theories in a dynamic perspective trying to come to terms with the consequences that the evolution in the knowledge base have in the evolution of organizations or regions.

It is the dynamic aspect we will develop in this paper.

Companies may be characterized by the way they manage knowledge in different levels of maturity (Khatiban et al. 2010). In initial stages, knowledge is barely managed, and is not seen as an important factor in the company; investment in knowledge is rather weak. In the second stage, knowledge is already recognized as an important asset, but actions in relation to it are still incipient. In a third stage, knowledge becomes the most important organizational assets and the organizational policies effectively are made around knowledge; in this stage investments in knowledge are big and the rewards for those

investments are also big. Quite interestingly, for regions and countries the same levels of maturity regarding knowledge also may be observed (Aubert 2005). In this case first we have low equilibriums regarding knowledge, when the country is poor and not developed, investments in knowledge are weak and knowledge is not a priority. Secondly we have middle equilibriums, when countries begin to emerge, investments became very important, policies are defined and the knowledge levels increase and so do the returns. Finally we reach the maturity stage, which exists in developed countries, in which investments are high, knowledge is the object of important public policies and the rewards from the investment are considerable. In that context, innovation should be the way of changing from a low level of maturity to a high level of maturity, for organizations or regions. Innovation may be social, or technical, and may be radical or incremental (Stam 2007).

Knowledge investments are a part of human and intangible investments. In the last decades those investments have been evaluated by a number of perspectives, namely social policy, Human resource economics, management / accountability, and human resource development experts. It is in this arena that both KM experts and Intellectual Capital studies make their analysis. Table 1 summarizes those six perspectives. It is very important to notice that they are complementary and that we consider that KM analysers must be aware of all the different perspectives when studying knowledge.

Table 1: Knowledge studies put in societal perspective

Perspective	User	Problem	Variables	Assessment Methods
Social Policy	Public administrator	Public good	Expenses, number of supported persons	Progress reports
HR Economics	Human Resource Economist	Impacts on society or organizations.	Wages, employment, productivity, exports	Control Group Input Output Methods Supply and demand methods
Management / Accountability	Private Manager Traditional Accountant	Impact on the organization	Profits	Return for investment
HRD science	HRD expert	Impact for the agents involved	Competences, learning, behaviour, company outcomes.	Interviews, Questionnaire, Participant – Observer
Intellectual Capital	New Accountants	Impacts on the organization	Market value minus book value	Balanced Scorecard: Finances, Structural Capital, Social Capital, Human Capital. Market value versus Book value.
Knowledge Management	Knowledge Manager	Impacts on the organization	Knowledge	Knowledge sharing, transfer, creation, dynamics, learning and unlearning

3.3 Approaches

Specification of a company's knowledge management maturity helps in determining both the current attitude towards knowledge and state-of-knowledge in the company and a company-specific strategy for implementing knowledge-related activities in order to improve company performance. Knowledge management maturity models provide a staged framework to initiate a step-by-step change within an organization based upon its current level of knowledge management maturity. In literature a number of knowledge management maturity models can be found (see Kochikar 2000, Langen and Ehms 2002, Joslin 2005). They usually originate from maturity models in software engineering and support companies in self-assessing their knowledge management maturity by answering questionnaires. Answers specify certain observable capabilities with regard to people, process and technology from which the current maturity level is derived. Kochikar (2000), for example, elaborates the following five levels of knowledge management maturity:

- Level 1 – Default. "Knowledge, we've got plenty of – what we need is to work hard."
- Level 2 – Reactive. "We need to leverage all our knowledge, but we're too busy to do that."
- Level 3 – Aware. "At least we've made a beginning in managing our knowledge."

- Level 4 – Convinced. “We’ve reached where we are by managing our knowledge well, and we intend to keep it that way.”
- Level 5 – Sharing. “We’re sharing knowledge across the organization, and are proud of it.”

Minonne and Turner (2009) propose a two-dimensional model for explaining the degree of progression in the development and implementation of a KM strategy. Here, one axis is used to ascertain the level of implementation and the other to pinpoint the degree to which implementation is managed, in other words the level of control. This way, again five stages of implementation and control maturity are defined. Problems in applying those models result from the pure qualitative design of the questionnaires and characteristics of maturity levels or stages which gives a lot of room for individual (mis-)interpretation and sometimes makes it difficult to the companies to identify the correct maturity level. Here, quantitative measures, e.g. key performance indicators, and a comparative approach might be of help both of which can be achieved from applying benchmarking methodology.

4. The background of knowledge-based change processes in companies

Any KM activity needs to influence company processes in a targeted and positive way with regard to economic efficiency and sustainability. Whereas the first focuses on using the organisational knowledge base for creating and maintaining highly-productive company processes and structures, the latter is oriented towards ensuring efficient and effective production and service provision and capacity for innovation. With this the company is able to offer new products or services and safeguard or even improve its position at the market. Therefore any knowledge-based company development forms a comprehensive change process that needs to be lead by the company’s management and where it is essential to take along the company’s employees. Exactly this kind of a challenge is in focus of change management. Change management is a structured approach to shifting/transitioning individuals, teams, and organizations from a current state to a desired future state. It is an organizational process aimed at empowering employees to accept and embrace changes in their current business environment (Hiatt and Creasey 2010). In general those changes might include anything from strategic company development to personal development of employees, but – as explained above - in this paper we focus on changes only which result from unlocking, gaining, developing and using knowledge as strategic resource.

Change management processes consist of four phases: preparation, diagnosis, intervention and post processing. The preparation phase aims to define the framework of change, to draft the process of change and to setup the structure of the change project. Diagnosis focuses on the definition of current and target situations and with this on the identification and specification of all problems to be solved. From this, needs for intervention and intended changes are derived. The phase of intervention wants to achieve changes by planning suitable measures and procedures, evaluating their potential impacts and finally launching them in the company. Their success is evaluated in the phase of post processing in order to identify the degree of target achievement and eventually still existing needs for further actions. Furthermore, findings and experiences (e.g. in the form of lessons learned) are to be derived from critical reflection and structured documentation of the change process. Here, knowledge management plays a major role as controlling and monitoring method for directing the change process. On the other hand knowledge management – or more concrete the intervention into company processes and structures by use of the knowledge resource – itself might become an activity in the change process. Those knowledge-based change processes can be seen as a specific version of the general problem solving process.

Any problem solving process is usually initiated by recognising a certain situation or behaviour as not satisfying (anymore) and eventually having a clear vision of how it should be ideally or even knowing what needs to be done to improve situation or change behaviour. In companies those processes typically aim at improving certain performance parameters like throughput, service level, time of delivery etc., improving the cost-benefit ratio of the company as a whole or of a particular product, service, process, or department, and maintaining or extending the company’s position at the market. The success, effectiveness and efficiency of any company development depends on how well the company knows its situation, how clearly and correctly it specifies problems and potential for improvements including their sources and drivers, and how purposefully and efficiently it selects and applies methods for solving problems and changing situation or behaviour. Here, knowledge and experience play a major role as problem-solving in a company context needs to be always knowledge-based and nowadays even more and more knowledge-focussed. Due to the complexity of today’s problems and processes in a company and because of the multi-facet appearance of, view on and benefit from applying the concept of knowledge, companies face the challenge to really manage, operate and understand knowledge as a

strategic resource. Therefore a methodological framework is proposed in order to help companies in identifying their needs for change and purposefully intervening in their processes and eventually to lend them a hand in managing their human resources, selecting technology or changing the organisation.

5. Methodological framework for unlocking the developmental potential of knowledge

5.1 How to help companies in identifying their needs for change

Pre-condition for any purposeful intervention in a company is a comprehensive understanding of company processes, its position at the market and its role within a network (or chain) of companies. Whereas this is usually given, companies quite often lack the ability to really see behind symptoms (in terms of observations or measures) and identify problems causing those symptoms and drivers enabling or hindering further development into the target direction. With this the true reason for a certain process result or company behaviour remains hidden or is found accidentally only. On this basis it is difficult or even impossible to correctly identify the needs for any change in the company in terms of both deficits and options.

Consequently, the process of knowledge-based and knowledge-focused intervention in a company needs to begin with specifying the company (the organization), i.e. the problem(s) to be solved and the context as well as environment it is (they are) located in. This includes information about the company environment, IT systems already used for any kind of knowledge management, the current state-of-implementation of knowledge management, the eventually planned or available investment volume, preferences with regard to KM activities or tools and the problem to be solved:

- The environment refers to the focus (single company or entire supply chain), company size, educational level of employees, company function, industrial sector, country or region etc. This is of relevance to the selection process, because KM activities, methods and tools appropriate for a small company may differ from those recommended for larger companies. For example, tools such as social software or internal networking opportunities are less important in small companies, since the employees easily have direct contact to each other.
- Existing IT systems can be used for or adjusted to KM needs. This eventually makes it easier and faster to implement further tools or launch new activities.
- The current state-of-implementation of KM gives information on the methods already implemented, activities and procedures already integrated into company life, tools already used. Further knowledge-based or knowledge-focused company development should directly build upon those existent, established and accepted activities, methods and tools, i.e. it is based on the company's current attitude towards knowledge and the knowledge culture already alive in the organisation. Possible interventions then could, for example, extend (upgrade) tools or take into consideration coherences between certain tools, methods and activities.
- The planned investment volume and the user preferences narrow down the range of KM activities, methods and tools to choose from in order to achieve highest possible acceptance of any changes to be implemented with both company management and company employees.
- The problem to be solved is one of the most important factors in recommending developmental steps as any intervention in the company must contribute to overcome the problem. This is the critical success factor; its evaluation requires a sound basis in terms of measures or processes.

For providing that information and in order to ensure their completeness and comparability the company manager (or user) should be supported by a self-reporting template, a structured questionnaire or even an easy-handling software tool based on selection dialogues or decision trees. In contrast to any paper-based tool an IT solution here might even get the user involved in an interactive mode (similar to an interview-based information retrieval) when it provides supporting functionality enabling the user either to directly enter requested data (if known and specified already) or to elaborate them step-by-step (if the user is inexperienced or available information are still ill-structured).

KM (software) tools, for example, which are already implemented (used) could be identified via a set of questions asking for knowledge-related activities and methods instead of tools. Those questions could focus on training activities, research and development, networking opportunities or the like which are not solely used for the purpose (or in the name) of KM and therefore may not be associated with it in

common terms. In combination with information on already existent IT systems this should allow in concluding on KM tools already in place.

This approach of indirect questions has already been applied in a questionnaire-based KM impact study (Neumann and Tomé 2005). Here, the questionnaire comprised five groups of questions addressed to different responsible managers in a company:

- The first group aimed at specifying the *main company characteristics*. Furthermore, in order to account for the dynamic of the firm, we asked if the company had recently incurred in some substantial change. These questions were to be answered by the top manager of the unit to which the data were related to.
- The second group should give a clue on the logistics manager's opinion about the *role of knowledge in the company*. Questions specifically dealt with the importance and dynamics of knowledge, the role of knowledge management with regard to the logistics processes or services, and whether or not Intellectual Capital (IC) Reports are produced.
- The third group asked the human resources (HR) manager to qualitatively assess specific *investments into knowledge* made in certain year fully relying on the good faith of the respondents. For this a detailed grid of 16 items was used that describe different ways of investing into knowledge (without investments into KM systems and IT infrastructure).
- The fourth group used the same grid and scaling as before to ask for the HR manager's opinion about the *importance of* providing employees with *access to* the 16 types of *investments into knowledge*.
- The fifth group was based on a grid of 32 company *performance indicators* related to economic factors, human relations within the company, customer relationship, operations within the company, personnel, production process, and strategy. To define the evolution of the company from before the investment into knowledge to after the investment, the unit's (company's) top manager was asked for classifying the respective company situations.

Whereas responses to the first four groups of questions give a clue on the company's current attitude towards knowledge (in correspondence with the KM maturity levels as mentioned in the Section 3.3), (qualitative) specification of performance indicators in relation to KM interventions should allow concluding on the impact certain KM activities had/have on company processes. With this the latter already lays the basis for purposefully intervening in company processes and recommending most suitable (or effective) KM methods or tools to be applied.

The weak point of the questionnaire is the missing link to problem identification, i.e. to WHY the company should change and into what direction. Here, questions and responses only allow a first rough insight from analysing input data by use of benchmarking and clustering methodologies (Neumann and Tomé 2010). On one hand, relating investments into knowledge to priorities of those knowledge-related activities leads to conclusions on the need for further investments into KM or for reducing or refocusing respective activities. On the other hand, results compare the company's attitude towards knowledge with that one companies of the same type show, e.g. by (anonymously) presenting investments into and priorities of the individual knowledge-related activities of those similar companies in a diagram. If company results significantly differ from those of similar companies then company attitude towards knowledge, its investments and priorities should be subject to further (and much more detailed) investigation as this eventually might indicate problems in KM.

To further specify those problems or help companies in identifying their problems (instead of repairing symptoms only), functionality for seeing the problems behind the symptoms could be of help. Methodically this functionality might work in the same way as an e-coach does (Neumann and Krzyzaniak 2006): the user goes through a list of symptoms or works with a decision tree to self-directed learn about the problem. Then, the support function matches the input against a problem-symptom matrix and suggests possible problems causing symptoms as described. Precondition for this is a detailed representation of relevant symptoms and underlying problems (corresponding to the type or business sector of the company). This is to be achieved through an ongoing learning process for improving matching functionality.

5.2 How to help companies in purposefully intervening in their processes

Once actual problems in company processes and/or performance have been identified, strategies for solving them through purposeful (knowledge-related or knowledge-focused) interventions can be found. For this, a clear target function in terms of a certain KM maturity level or a performance situation to be achieved is required. Amongst others it can be derived from SWOT indicators as defined from intercompany/interarea KM maturity benchmarking. Based upon this the overall change process can be designed, but also options for how to purposefully intervene through knowledge can be specified. Questions to be answered in this context are:

- Which of the necessary changes can be achieved through knowledge?
- How the company knowledge base has to be developed?
- How to best make use of a company's "soft skills" (i.e. knowledge and competence)?

Based upon this, KM methods and tools fitting to the specific situation and required change can be recommended. These recommendations should be accompanied by a detailed description and an implementation checklist. In case a variety of interventions seem to be appropriate a kind of filter can be used to narrow down the options. Possible characteristics to sort and filter results of this specification step can be, for example, preferences with regard to the KM aspect to be influenced, i.e. technology, human resources or organization, or limitations of the change process such as level of investment available.

Additionally, coherences between particular methods, activities or tools might be pointed out and discussed if this is important for them to work effectively. This even might lead to the proposal of a development pathway composed from different methods and activities to be applied or implemented one after the other. Here, KM maturity levels form a pattern of developmental steps with a specification of what needs to be done to move from one level to the next one. This KM maturity development pathway is not a straight line nor is it the same for all situations and companies. Instead, there are milestones along the way which can be reached through a particular sequence of KM interventions applied in a certain context and therefore give company managers orientation in developing an appropriate strategy for knowledge-based and/or knowledge-focused development.

As there is usually not just one potential option to intervene in company processes another challenge consists in deciding about which of these options might be the best one in terms of success, effectiveness and efficiency. Here, a test-bed for scenario-based evaluation of possible intervention strategies is of great help requiring a sensitivity model that explicitly shows the interactions between KM activities and a set of measures for evaluating their effectiveness (i.e. impact) and efficiency (i.e. costs). Carrillo et al. (2003) investigated the relationship between KM and business performance in order to develop a three-stage framework for Improving Management Performance through Knowledge Transformation (IMPaKT). It comprises activities for developing (i) a business improvement strategy, (ii) a KM strategy, (iii) a KM evaluation strategy and an implementation plan. Here, effectiveness of KM is assessed in terms of the degree to which strategic objectives of the business organization are realized. For this a cause-effect-map is proposed that relates KM initiatives to performance measures and strategic objectives. The challenge in applying this rather general map to a certain company setting mainly consists in defining cause-effect relationships in detail and clearly specifying the quantitative or qualitative impact of a certain KM initiative on appropriate performance measures. For this, a company performance model is required that can be tailored to the business sector and particular company setting. Therefore, a cause-effect model has been developed by applying Vester's sensitivity analysis method of networked thinking (Vester 2000) that represents interactions between a company's key performance indicators in both ways qualitatively and quantitatively (see Figure 2). As it hypothetically can be seen as mode of operation of a profit-making company it might form a generic model of business management enabling to investigate the role of different business aspects in the complex system of business performance.

A second sensitivity model, the knowledge-activity model, is based upon a similar approach as the business management model. The underlying assumption is that all KM initiatives, activities, methods, strategies, tools do not only influence the system they are applied to or set up in, but even further that they also influence each other when coming in place at the same time. As any KM initiative quite often does not consist of just one specific activity, like e.g. implementing a KM IT system, but contains a bunch of activities addressing technological, organisational and human factors at the same time, the impact of the initiative on the company performance cannot be evaluated without taking interferences between

newly launched and already running KM activities into account. Due to the many and diverse KM tools (in the widest sense) it does not seem to be possible nor useful to try to create the ultimate knowledge-activity model covering all of those tools. Instead it is necessary, either to focus on those tools already in place in a certain company setting in order to analyse which are effective and efficient ones and which are not, or to build the model based upon a pre-selection of suitable tools in order to evaluate and compare them according to their effectiveness and efficiency. The latter allows selecting the most appropriate tools and also checking in advance if the intended effects might be achievable at all.

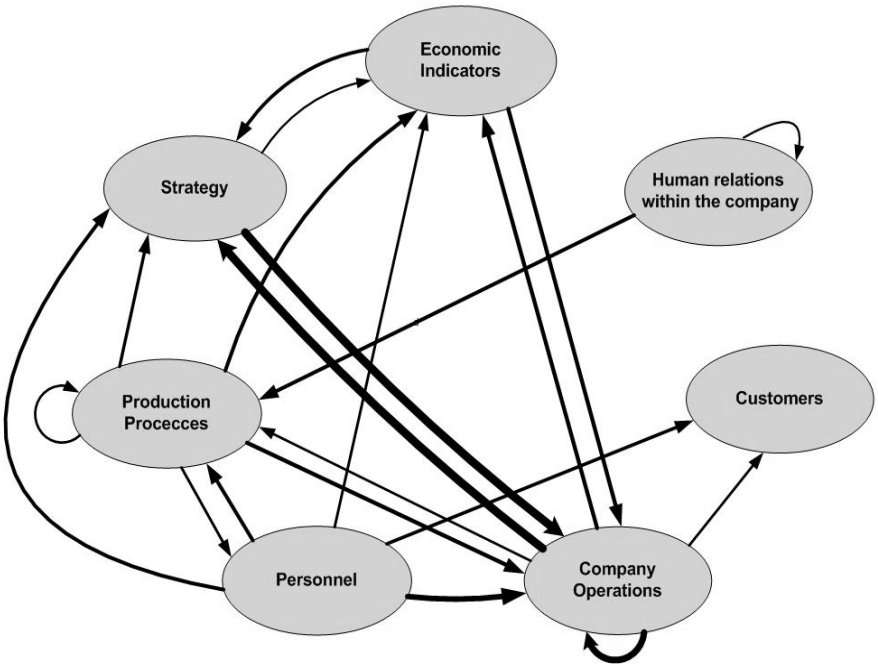

Figure 2: Cause-effect map of aggregated variables

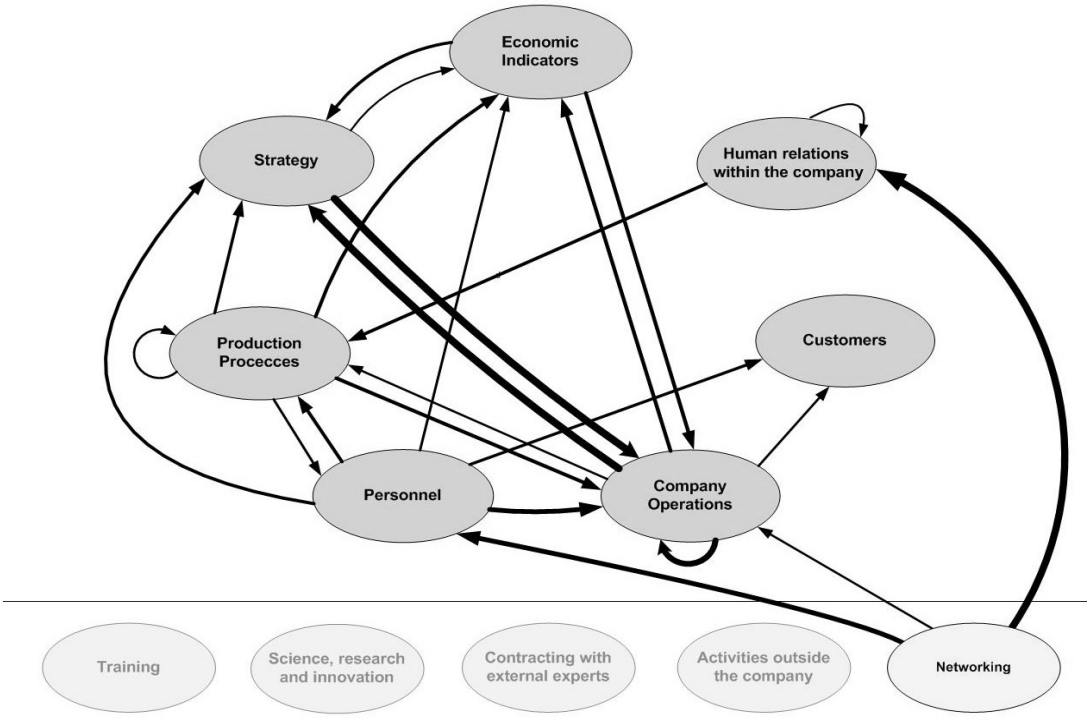

Figure 3: Cause-effect sub-model: impact from networking activities

For purposefully interlinking both models relevant links between them are to be specified, i.e. the control levers in the company system operated by the output variables of knowledge-activity have to be identified and effectiveness as well as efficiency of their intervention must be defined. To be able to more clearly describe each of these effects in terms of both the time until they start impacting and the strength they achieve, the individual options for intervening and their respective effects are represented in separate sub-models (see Figure 3). These sub-models contain influences by a single effective control lever only, but show all effects directly or indirectly resulting from its intervention. To identify the most promising activities for achieving a particular change of the system all options to influence the system (control levers) would have to be investigated via a before and after comparison. On the other hand, the strength of the effects and the time until they appear could be derived by use of simulation. In the end, possible options of investments in knowledge or KM can comparatively be analysed in terms of their company-specific impacts and with respect to their contribution to achieving a defined level of improvement in relation to the respective need for investments. However, a serious prerequisite for such findings is in any case a valid cause-effect model of both the business management and the knowledge-related activities as external control levers.

6. Conclusions and further research

In order to better manage knowledge for unlocking its developmental potential a comprehensive set of methods is required that helps companies in purposefully intervening in their core processes. As those interventions can either be caused by a certain problem or unsatisfying situation or initiated from a kind of regular routine check-up, this methodological framework also describes the fundamental concept of a "knowledge clinic". That "knowledge clinic" would enable companies to adjust from their actual maturity level to the desired maturity level and also to run sensitivity analysis on their knowledge investments in the same way as any process of medical treatment with the human body is (or at least should be) organised: diagnosis – healing – evaluating/cross-checking.

To identify options for knowledge-based and knowledge-focused company development it is necessary to know about knowledge resources, methods and tools already available in a company setting as well as their current level of implementation and application. Furthermore, an in-depth understanding of the problems to be solved (rather than just the symptoms to be seen or measured) or the objectives to be achieved through knowledge-related interventions is required. These investigations form the diagnosis phase of knowledge-based development in a four step procedure:

- 1. Define the constituents of the market for regions or the situation regarding those constituents for organizations;
- 2. Define benchmarks for companies and for countries;
- 3. Compare countries and organizations with those benchmarks.
- 4. Diagnose problems using the mentioned benchmarks.

The healing phase of knowledge-based development uses KM maturity pathways and scenario-based impact models to identify the most appropriate means and strategies to intervene in company processes for solving the problems as specified before and achieving the target development as intended.

Evaluation or cross-checking uses simulation methodology with sensitivity models in order to determine the impact a certain intervention might have on the company and to compare this impact with intentions. This last phase of knowledge-based development ensures the success of any intervention and supports critical reflection on what could be achieved in which way in order to find the most effective way of intervention. With this, it also contributes to a learning process for ongoing improvement of both the intervention strategy for knowledge-based company development and the procedure for deriving and implementing it.

At the present stage, the research findings are essentially questions and not answers. In order to proceed by implementing the "knowledge clinic" the following steps have to be done:

- 1. Integration of existing KM methods, tools and benchmarks into the framework (including specification of their applicability or limitations)
- 2. Creation of a web portal;
- 3. Collection of data on companies;
- 4. Definition of benchmarks and quantitative characteristics of KM maturity levels;

- 5. Implementation of a self-learning algorithm for developing company-specific intervention strategies;
- 6. Operationalization and dissemination of results.

We would like our portal to be something like a KM hospital for organizations and companies, i.e. we create an Internet facility in which each company would serve itself in KM terms. This means each company would have to find some data about itself and provide them via the website to be able to make a diagnosis of its own situation and to trace a road map about the ways it would need to improve its business performance and KM maturity. The website would therefore be an interactive instrument for companies on one hand contributing to permanent improvement of the portal's rule base but also obtaining some very important information about themselves on the other. We would therefore obtain a win-win situation through a collaborative game. Of course, companies might profit from the situation entering false data, but this is a circumstance that quite unfortunately may happen in every survey and we expect that situation not happening frequently enough to destroy the validity of the conclusions derived.

Few would argue about the importance of knowledge in a long run sustainable economy. However, we absolutely lack the instruments at organizational and at national level to successfully guide those investments. Accordingly this paper proposes a model which tries to understand knowledge as a dynamic force of change in an economic environment and setting. We therefore believe the creation of a "knowledge clinic" will be necessary to improve the management of knowledge at the levels of society and economy, too.

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