Knowledge Process Models in Health Care Organisations
Ideal-typical Examples from the Field

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Abstract: This paper summarizes the recent work of analysing knowledge process in health care organisations with a special focus on the geriatric disciplines. A study has been performed consisting of observations in the field and interviews with the professionals. It is shown that knowledge processes have evolved over the past years. New knowledge processes are introduced and modelled by using a combined method (3LGM^2 and KMDL$^®$). An outlook is given on measuring the dissemination of knowledge through the identified processes in ongoing work.

1 INTRODUCTION

The increase of knowledge and information is a general phenomenon and thus also applies to healthcare. Emerging cooperation between health care organisations (HCO) and in addition Mergers & Acquisitions by highly integrated health care groups extend the organisational knowledge base even more. In addition medical schools and medical university hospitals represent key actors in medical knowledge development (Rölker-Denker and Hein, 2012b).

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2 LEARNING ORGANISATIONS

Learning organisations can be described from different viewpoints. In this paper the learning organisation is analysed in sense of Wengelowski. He defines three main areas: learning levels, learning types and learning determinants, which all can be practically mapped over an organisation for analysing its accordance with the learning organisation concept (Wengelowski, 2000).

Four learning levels can be distinguished: individual learning, group (team) learning, organisational learning and inter-organisational learning. Individual learning means the changes in behaviour, theories and concepts by an individual whereas group learning means the same in a group context. Organisational learning focuses on the changes in organisational behaviour or theory. If more than one organisation is involved in the learning process then inter-organisational learning can be identified.

Learning types can be differentiated into single-loop learning, double-loop learning and deutero learning (Hislop, 2009). Single-loop learning focuses on incremental changes inside a constant framework while double-loop learning focuses on the framework. Finally, the process of learning and extending an organisation's awareness itself is in the focus of deutero learning. The learning types are based on each other. The abstract theories of learning levels and types are brought together into the organisation by the learning determinants. Three determinants are discussed in literature: organisational member, organisational structure and organisational culture (Wengelowski, 2000). The specific utilization and advancement of competencies and qualifications among the organisational members are fundamental tasks in learning organisations. Each organisational member has its unique setting of competencies and qualifica-tions, e. g. professional or social competence.

Important levers are human resource development (further and advanced education) as well as staffing. The formal organisational structure gives the framework for all intra-organisational and partly inter-organisational processes and sets the scope of action for the organisational members. Following the organisational view a differentiation can be made between organisational structure, process organisation, communicational / knowledge organisation and informational organisation. The organisational structure describes the long-term primary organisation (functional, divisional, matrix organisation) and flexible short-term organisation (such as project organisation); the process organisation describes how organisational tasks are executed. The communicational / knowledge organisation describes how knowledge is shared inside organisations and which communicational areas can be used. The informational organisation contains written, spoken and IT-based information systems. Organisational culture can be interpreted as the informal organisational structure. In context of the learning organisation three different types of culture can be distinguished: learning culture, communication culture and culture of trust (Rölker-Denker, 2010). This definition of learning organisations has been already used in previous studies and ensures the comparability of actual and future work with recent studies. As a result of this recent work a method for modelling organisational learning processes was declared to be useful (Rölker-Denker et al., 2011).

3 MODELLING APPROACH

3.1 State of the Art

Modelling knowledge processes can be achieved with different languages. UML (Unified Modelling Language) is one approach which is used for this purpose (Schreiber and Akkermans, 2000), other approaches are EPCs (Event-driven process chains) or petri nets (Fröming, 2009). These modelling approaches have been developed without a guiding knowledge management theory like the knowledge management model from Nonaka and Takeuchi (Nonaka and Takeuchi, 1995). This applies for the Knowledge Modeling and Description Language - KMDL® (Gronau and Fröming, 2006), see chap. 3.3.

In the area of modelling clinical IT infrastructures a key concept is a conceptual architecture showing the included systems and areas (Locatelli et. al., 2012). These approaches lack a

detailed technical view, e.g. showing tasks and subtasks. This applies to the Three-Level Graph-Based Meta Model for the Management of Hospital Information Systems - $3LGM^2$ (Winter and Haux, 1995), (Winter et. al., 2003), see chap. 3.2.

For the description and modelling of organisational learning routines these two well-proven concepts have been selected and combined for the first time to meet the demand for modelling organisational learning routines in health care organisations. Both concepts are introduced in brief, for more details see (Rölker-Denker and Hein, 2012a).

3.2 $3LGM^2$

$3LGM^2$ is used for modelling hospital information systems and architectures. Models build with $3LGM^2$ use a simple intuitive notation. It can not only be used for modelling hospital information system but also connections to hospital's environment like physicians, care-givers and other HCOs. $3LGM^2$ is based on three layers: domain layer, logical tool layer and physical layer. The domain layer describes typical tasks and subtasks in a HCO like patient scheduling or radiological reporting. The logical tool layer comprises concrete systems like hospital information systems (HIS), radiology information systems (RIS) or picture archive and communication systems (PACS). Finally the physical layer describes physical hardware (PCs, server, switches) and social-technical elements (mail in-trays, archive) and the connections between these elements. The physical layer is left out at the moment due to its subordinate relevance in analysing knowledge processes (Winter and Haux, 1995), (Winter et. al., 2003).

3.3 KMDL®

KMDL® is used for modelling knowledge processes in organisations. It is based on the knowledge management model from Nonaka and Takeuchi (Nonaka and Takeuchi, 1995) with its four phases of socialisation, externalisation, combination and internalisation. KMDL® is divided into process layer and activity layer. Tasks, the order of tasks, information systems, functions (provided through information systems), roles and persons are part of the process layer. Objects of the activity layers are information and knowledge objects, single persons (or teams), requirements and the different transformations between the four knowledge management phases (Gronau and Fröming, 2006).

3.4 Consolidation

On the functional layer 3LGM^2 solely describes typical hospital task and is not process-oriented. However KMDL$^®$ describes processes and focuses on information systems, roles and especially tasks on the process layer. The connection of both concepts can be achieved by mapping 3LGM^2's domain and logical tool layer and KMDL$^®$'s process layer. The result is a fourth layer above the functional layer of 3LGM^2 and can be understood as a knowledge layer. The knowledge layer is connected to the domain layer by tasks and roles and to the logical tool layer by information systems. Using the knowledge layer it is possible to map knowledge processes into a HCO and identify key success factors for these processes (Rölker-Denker and Hein 2012a).

3.5 Graphical Representation

The following symbols are used in this work:

- *Conversion*: A knowledge conversion following Nonaka/Takeuchi, e.g. externalisation or internalisation.
- *Knowledge Object*: A complex object of knowledge, describing how knowledge is acquired for the organisation e.g. creating a sophisticated report or staffing well-educated personnel.
- *Information Object*: A simple information object, e.g. letter, x-ray image or laboratory report.
- *Requirement*: A functional or technical requirement, e.g. a software system to be used
- *Person*: A person taking part in the process
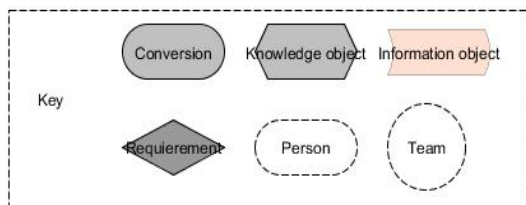- *Team:* Multiple persons forming a durable team

Figure 1: Key (activity view).

4 MODELLED LEARNING PROCESSES

In a first step the learning processes were identified in field studies by shadowing the daily work in different clinical departments (acute geriatric, neurology, stroke unit, neurosurgery, and nephrology) in two hospitals, one municipally and one confessionally owned. Each department was visited for one to two days (depending on the unique work flows) by one observer, afterwards draft models were developed and in the end discussed in semi-structured narrative interviews with selected professionals involved in the processes (Rölker-Denker and Hein, 2012b).

The following organisational learning routines have been identified and observed (Rölker-Denker and Hein, 2014):

- Physician rounds
- Reflection meetings
- In/after surgery meetings
- Staff meetings
- Consultation
- Early Stand-up Meeting
- Multi-professional geriatric team session
- Interdisciplinary clinical case conferences
- Discharge management

These learning routines have been identified in all clinical departments except the multi-professional geriatric team session which is specific to geriatrics. The learning routines have been also validated by expert interviews in a research project for building a health services research network (Rölker-Denker et. al., 2014). These interviews have been conducted with the medical and/or economic management of more than 20 hospitals in the northern part of Lower-Saxony, Germany. Some of these learning routines (physician rounds, reflection meetings, in/after surgery meetings, staff meetings) have been already discussed in literature (e.g. Lipshitz and Popper, 2000) and have been confirmed during this study. Some of the new identified organisational learning routine will be described in the next paragraphs.

Each routine will be introduced by a so-called storyboard, derived from clinical practice. Based on these storyboards the routines are modelled and described in detail.

4.1 Multi-professional Geriatric Team Session

Storyboard

In the morning, Doctor A, an assistant geriatrician, is updating the EHR of his/her geriatric patients. He/she uses the GERDA (Geriatric Database), a software component integrated into the HIS. He/she updates his/her observations on the patient regarding the general

state, his/her interpretation of laboratory values etc. He/she also sees the entries of the members of the multi-professional geriatric team. In the afternoon he(she meets with the other members and discusses the patient development. As the patient's discharge is planned for end of the week the medical social worker reports the current state of negotiations with an ambulatory care service in the city which will take care of the patient after discharge.

The multi-professional geriatric team session process is shown in figure 2, particular process steps are:

- *MGT - Multi-professional Geriatric Team:* The team consists of doctors, nurses, logopedics, physiotherapeutists, occupational therapeutists and medical social workers.
- *Updating EHR*: All team members update the EHR with the relevant professional information. Each profession has its own input fields. This is the externalisation step.
- *Team Session*: The MGT meets and discusses all patients on the basis of the information within the EHR. This includes the current state, future developments and treatments as well as all other business regarding the patient. This is the combination step.
- *Treatment*: With the combined information out of the team session all members can continue with the coordinated treatment.

4.2 Interdisciplinary Clinical Case Conferences

Storyboard

The internist Doctor A has a patient with an unclear oncological diagnosis. He/she decides to sign on this case for the clinical conference. All oncologist of the hospital meet at weekly basis and discuss patients with difficult/severe diagnoses. The conference participants examine the documents (reports, medical images) and give a recommendation and report. The assistant of a doctor attending writes the final report and updates the EHR. In the end Doctor A reads the updated EHR and the report and can use this for the further treatment of his/her patient.

The clinical conference is shown in figure 3, particular process steps are:

- *Sign on Case*: Doctor A signs up his/her patient for the clinical conference to be discussed.

- *Analyzing Case*: All attending doctors, including Doctor A, analyse the provided information objects (e.g. images, reports; internalisation step) and discuss recommendations for further treatment (internalisation). The result is a consolidated recommendation (combination) as new knowledge object.
- *Writing Report*: The assistant writes a report containing the recommendation, resulting in a new information object.
- *Updating EHR*: The assistant loads the report into the EHR.
- *Reading*: Doctor A reads the updated EHR and can use this knowledge for the further treatment of his/her patient.

4.3 Discharge Letter

Storyboard

Doctor A, a senior geriatrician, starts writing the discharge letter for his/her patient. When he/she has finished his/her draft the discharge letter is corrected by the chief geriatrician Doctor B. Doctor A can finalise the discharge letter. The discharge letter is forwarded to the department assistant who sends to letter by regular mail to the family physician of the patient.

The discharge letter (DL) process is shown in figure 4, particular process steps are:

- *Writing DL*: Doctor A writes the DL draft by using the updated EHR with images, reports etc. This is the externalisation step.
- *Correcting DL*: Doctor B corrects the draft DL, the result is the corrected DL. This is the combination step.
- *Finalising DL*: Doctor A finalises the corrected DL and forwards it to the department assistant.
- *Sending DL*: The department assistant sends the DL to the family physician in charge. This is the step where the sector boundaries are overcome.
- *Receiving DL*: The family physician in charge receives the DL and updates the patient EHR in his/her office. Reading the patient's DL is the internalisation step.

5 CONCLUSION AND OUTLOOK

5.1 Conclusion

Health care has evolved in the recent years and this

also applies to organisational learning routines. Emerging specialisation in medicine regarding more specialised disciplines (e.g. geriatrics as a specialisation of internal medicine) or occupational profiles (e.g. case management, palliative care nurses) and enforced inter-profession cooperation between physicians, nursing and other professions have changed organisational learning routines like the multi-professional geriatric team session. The scope of organisational learning has also changed, starting from learning routines inside hospital boundaries up to inter-organisational (between several hospitals) and even inter-sectoral (between hospitals, rehabilitation organisation and ambulatory actors).

Well-described learning routines have been proven in the field but also new ideal-typical organisational learning routines have been identified and have been introduced in detail. The demonstrated organisational learning routines have been modelled from field observations and can be stated as ideal-typical routines.

5.2 Outlook

In a next step the velocity of knowledge dissemination will be measured and factors influencing the velocity will be identified, e.g. how long does it take to use the knowledge from a consultation report in the patient treatment process.

These measurements and influencing factors will be the basis for remodelling proposals. These proposals could focus on remodelling the learning routine itself by rearranging the process steps, eliminating negative influencing factors, or reinforcing positive influencing factors. New process steps or links between actors are possible.

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REFERENCES

Fröming, J., 2009. *Ein Konzept zur Simulation wissensintensiver Aktivitäten in Geschäftsprozessen*, GITO, Berlin.

Gronau, N., Frömming, J., 2006. KMDL® Eine semiformale Beschreibungssprache zur Modellierung von Wissenskonversionen. In *WIRTSCHAFTS-INFORMATIK*. Gabler Verlag. Wiesbaden. (German).

Hislop, D., 2009. *Knowledge Management in Organizations. A critical Introduction*, Oxford University Press. New York.

Lipshitz, R., Popper, M., 2000. Organizational Learning in a Hospital. In *Journal of Applied Behavioral Science*.

Locatelli, P., Restifo, N., Gastaldi, L., Corso, M., 2012. Health Care Information Systems: Architectural Models and Governance. In *Innovative Information Systems Modelling Techniques*, Kalloniatis, C. (Ed.), InTech, DOI: 10.5772/38212.

Nonaka, I., Takeuchi, H., 1995. *The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation*. Oxford University Press. Oxford.

Pfaff, H., 1997. Das lernende Krankenhaus. In *Zeitschrift für Gesundheitswissenschaften*. (German).

Rölker-Denker, L., 2010. Hospitals as Learning Organizations. In *Proceedings of the IADIS International Conference e-Health*.

Rölker-Denker, L., et. al., 2011. The organizational learning cube. Adopting the data cube model for analyzing organizational learning in healthcare organizations and networks. In *Proceedings of 9th International Conference On Information Communication Technologies In Health*. National and Kapodistrian University of Athens, Greece.

Rölker-Denker, L., Hein, A., 2012a. Modelling Knowledge Processes In Health Care Organizations. In *Proceedings of The International Workshop on Applied Modeling & Simulation*.

Rölker-Denker, L., Hein, A., 2012b. Lernende Krankenhäuser aus versorgungsforscherischer Perspektive. Studiendesign und Methodeninventar. In *DMW*. Thieme (German).

Rölker-Denker, L., Hein, A., 2014. Organisationale Lernroutinen in der geriatrischen Akutbehandlung und Rehabilitation. Ergebnisse einer qualitativen Studie. In *Zeitschrift für Palliativmedizin*. Thieme. (German).

Rölker-Denker, L., Seeger, I., Sass, D., Hein, A., 2014. Projektvorstellung „Netzwerk Versorgungsforschung Metropolregion Bremen – Oldenburg". In *Zeitschrift für Palliativmedizin*. Thieme. (German).

Schreiber, G. T., Akkermans, H., 2000. *Knowledge engineering and management: the CommonKADS methodology*, MIT Press Cambridge.

Wengelowski, P., 2000. *Entwicklung organisationalen Lernens. Ein Lenkungsmodell*, Deutscher Universitäts-verlag Wiesbaden. (German).

Winter, A., Haux, R., 1995. A Three-Level Graph-Based Model for the Management of Hospital Information Systems. In *Methods of Information in Medicine*.

Winter, A., et. al., 2003. 3LGM2: Methode und Werkzeug zur Modellierung von Unternehmensarchitekturen im Krankenhaus. In *Proceedings der Frühjahrskonferenz 2003 des GI-Arbeitskreises Enterprise Architecture*. Institute for information management, University St. Gallen, Switzerland. (German).
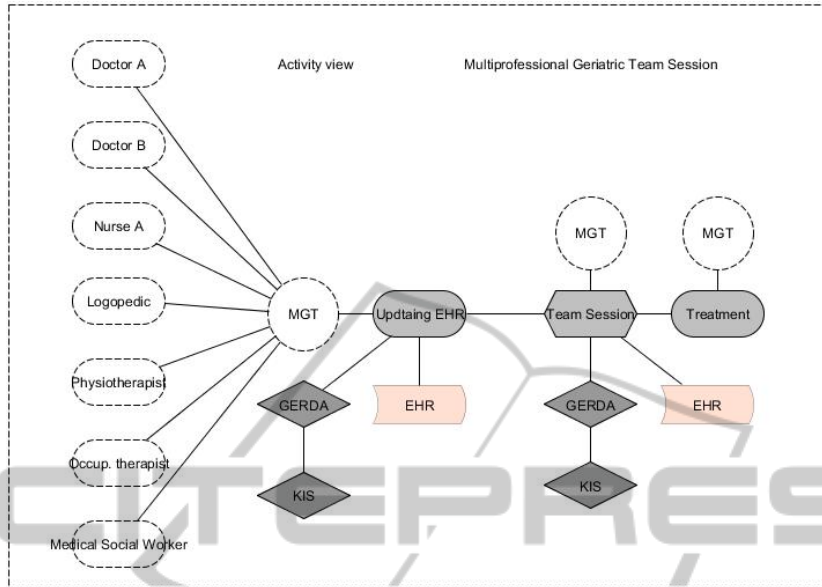
APPENDIX

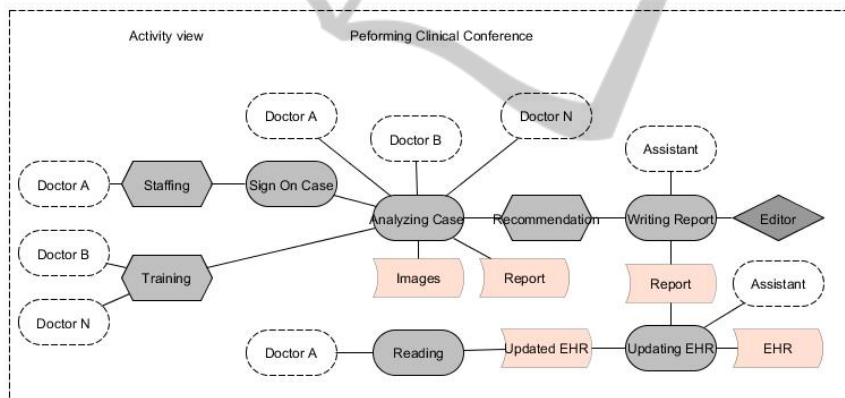Figure 2: Multi-professional Geriatric Team Session (activity view).
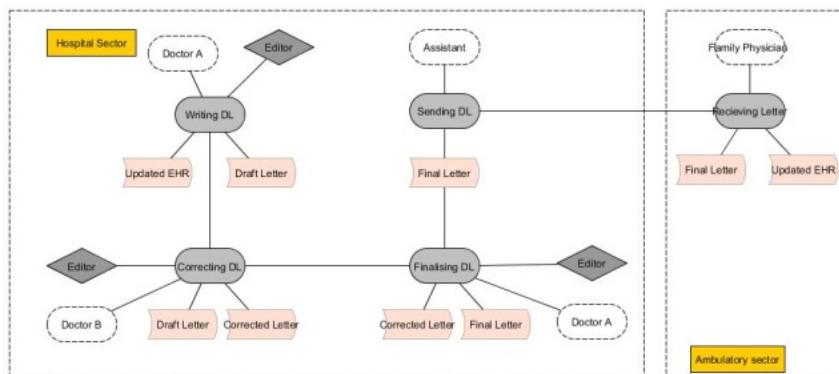

Figure 3: Clinical conference process (activity view).

Figure 4: Discharge letter (activity view).