Chapter Seven

Conclusion
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CONCLUSION

"As often as a study is cultivated by narrow minds, they will draw from it narrow conclusions."

7.1 Introduction

Knowledge management has become increasingly important in the hypercompetitive environment, in which organizations must increasingly operate [99], [100]. Practitioners have been making tremendous efforts to apply the principles and techniques of knowledge management, while researchers have endeavored to better understand them.

This thesis has introduced the idea that tacit knowledge can be articulated using the implied knowledge therein. We suggested that tacit knowledge may be embedded in grammar without the direct awareness of the individual and explained grammatical features, referred to as under-representation that a mode could track. We developed and piloted a framework based method that attempted to unpack under-representation through targeted modes. This method was the basis of previous frameworks for knowledge management and knowledge acquisition models and this framework has extended the implications of these frameworks and models.

From the technical point of view the solution seems to be simple. It is technically feasible to design an IT solution to share, manage, update and coordinate knowledge. But the real challenge starts when human factors are involved into the question. Two
aspects of human factors are clear in knowledge management via IT. First factor is the tacit knowledge embodied in people. Second, the continuity and efficiency of the IT systems depends on the level of commitment of the people using the system.

7.2 Limitations of the Research

IT is an important tool but cannot do everything alone. Investments by expecting too much from IT would fail to success. Therefore many believe IT is very important for organizations who want to manage knowledge, take a pessimistic view on IT. It is easy to come up with a technical solution but no matter which solution is put into place, organizations should always remember the human factor. IT systems are highly dependent on people to be continuous. If local units are not committed to the system, they won't put the required updates on time. Moreover, it is impossible to share the knowledge completely via IT due to its tacit components which are incorporated in people. Organizations should be careful not to fall into the trap of productivity paradox of IT. IT does not bring the solution alone; it needs to be supported by other mechanisms to be efficient.

The implementation can further be enhanced to involve more patterns of tacit knowledge, because of the human factor. As suggested there are a lot more areas of improvement which can be incorporated with this system to have a better management of the knowledge. Knowledge in its entirety cannot be handled even though there are advancements in technologies and human thinking. Therefore it is for the individual or the organization who wants to manage knowledge in a better way implement simpler yet effective knowledge management solutions like the one suggested in this thesis.
In recent years, the demand for KMSs has increased dramatically. They are used in applications ranging from medicine to engineering and aerospace to finance. As KMSs are being called on to provide automation in increasingly complex domains, the complexity and difficulty of building a KMS increases dramatically.

Knowledge acquisition, in particular, is one of the most difficult and error-prone tasks in building these types of systems. Knowledge acquisition involves identifying the relevant technical knowledge, recording it, and getting it into computable form so the problem-solving engine of the expert system can apply it. Knowledge acquisition is a form of requirements analysis, which plays a critical role in building quality software. Requirements analysis in general is the process of identifying a user's needs and determining what to build in a system. It has been shown that defects injected into software during requirements analysis are costlier to correct than those injected during subsequent phases of the development life cycle. Research has also shown that many system failures can be attributed to the lack of clear and specific requirements analysis. The financial consequence of poor requirements analysis has long been understood. In fact, knowledge acquisition is the most difficult and expensive part of building and maintaining expert systems.

To elicit knowledge from an expert, the traditional approach to knowledge acquisition is that, regardless of the variation used, it is costly because at least two (typically) expensive people are involved (i.e., the domain expert and the knowledge engineer). The second thing to note is that the methods are error prone. Surprisingly, people cannot easily say what it is that they do in a manner that can be understood by others. This is mostly because skills are usually learned through apprentice-style
learning, and the small, faltering steps required by the expert during initial learning have long since become embedded in longer phases of automated behavior, and the constituent steps are no longer readily accessible. Therefore, interpretations of what the expert does are often faulty and incomplete, sometimes based on rationalizations by the expert of what they think they are doing rather than what they actually are doing. These misinterpretations are often easily committed by well-trained knowledge engineers, let alone less well-trained practitioners.

The third thing to note about the traditional approach to knowledge acquisition is that it is time consuming because errors, gaps, and inconsistencies may be difficult to discover, requiring many interactions between experts and knowledge engineers to debug a field-ready application.

As knowledge acquisition continues to be one of the most difficult and error-prone tasks that a knowledge engineer does when building a knowledge-based system, the cost and performance of the application depends directly on the quality of the knowledge acquired. During this process, the knowledge engineer must determine where in the organization the knowledge exists, how to capture it, and how to disseminate this knowledge throughout the enterprise. As discussed in this thesis, an important method to capturing or modeling knowledge is to incorporate the proposed framework. Using the framework for knowledge acquisition will allow for a consistent method for capturing the knowledge of a particular enterprise, organization, or human (domain) expert.

The proposed framework in this thesis addresses specific needs of the knowledge engineer during the knowledge acquisition process. These needs include the capability to
decompose the knowledge acquisition task into manageable subtasks, focus on a
representation of expertise that is natural to domain experts, to recognize the patterns in
knowledge, and to resolve conflict when aspects of knowledge of a particular domain
become uncertain.

In any KMS there are three main activities—knowledge generation, knowledge
sharing, and knowledge codification. Our framework addresses all these in detail.
Nonaka (1994) explains these activities in a comprehensive theory about organizational
knowledge creation based on interactions between tacit and explicit knowledge. The
process begins with the enhancement of an individual's tacit knowledge through hands
on experience, supporting the generation of knowledge. Socialization then follows,
involving the transfer and sharing of tacit knowledge between individuals. Dialogues
allow the conceptualization of the tacit knowledge and trigger externalization—the
transformation of knowledge from tacit to explicit. Finally, the knowledge is combined
with existing knowledge and codified.

Models are used to capture the essential features of real systems by breaking
them down into more manageable parts that are easy to understand and to manipulate, as
indicated in our framework. Models are associated with the domain they represent.
According to Booch, "A model is a simplification of reality." Real systems are large
entities consisting of interrelated components working together in a complex manner.
Models help people to appreciate and understand such complexity by enabling them to
look at each particular area of the system in turn.
Models are used in systems development activities to draw the blueprints of the system and to facilitate communication between different people on the team at different levels of abstraction. People have different views of the system and models can help them understand these views in a unified manner.

The modeling process constructs conceptual models of knowledge-intensive activities. According to our framework, during the knowledge acquisition stage, most of the knowledge is unstructured and often in tacit form, although it can take on other forms such as procedural, declarative, and explicit. The knowledge engineer will try to understand the various types of knowledge and then use simple visual diagrams to stimulate discussion among users and knowledge experts. This discussion process generates ideas and insights as to how the knowledge is used, how decisions are made, and the factors that motivate, and so on.

The knowledge engineer then has to construct the conceptual model from what has been discussed during the knowledge acquisition stage. This communicates the knowledge to the knowledge engineer, where the knowledge base can be designed, constructed, and implemented. Many authors of KMSs have discussed the importance of knowledge modeling in KM.

The argument is that models are important for understanding the working mechanisms within a knowledge-based system, such as the tasks, methods, how knowledge is inferred, the domain knowledge, and its schemas. Conceptual modeling is central to knowledge engineering. Modeling contributes to the understanding of the source of knowledge, the inputs and outputs, the flow of knowledge, and the
identification of other variables such as the impact that management action has on the organizational knowledge.

We anticipate incorporating our framework in the development of KMSs will generate widespread benefits. This will result in the development of KMSs with reduced costs, less errors, and less development time. Furthermore, these systems will be more effective at automating knowledge-based tasks. This has the potential to advance the state of the art in the knowledge engineering field.

7.3 Recommendations for Further Research

The suggested framework and model deals with the provision of using a Knowledge management system as a whole. But there are definitive areas in the implementation of the framework that requires improvement with technological advancements. Refinements in the number of sources attached that will facilitate the expert to contribute may vary from simple to complex interfaces and forms a scope for further research. In the extraction process we have considered only textual information and audio and video information may also be considered for future research. Also suggestive are the conversion of knowledge into plain language which is a research area of its own. Plain language\(^7\) or plain English is relatively new and requires more formation, but a knowledge fabrication into plain language can definitely be utilized by both human and machine.

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\(^7\) Plain language (also called Plain English) is communication the users can understand the first time they read or hear it. Plain language is defined by results—it is easy to read, understand, and use.
Knowledge Update

Today environments are rapidly changing and the same applies to knowledge. This covers technologies and products, but also politics (e.g. legislation). Consequently, there arises a need to verify if knowledge is still up-to-date in order to exclude expired knowledge. The validity of knowledge has to be checked and outdated knowledge needs to be updated or removed. To perform these activities, one needs to identify the need for such actions first.

To know and accept that knowledge and its use change over time is an essential principal that needs to be addressed in KM. Even small changes in the environment and/or the working processes may require the knowledge to be modified. While this kind of change might sometimes be predictable, so that the according knowledge packages can be updated beforehand, it is likely that especially smaller changes happen without (all) the knowledge being updated accordingly. Needed changes to knowledge need to be identified, because the acceptance of the whole system might be endangered as outdated knowledge calls the system in question as a whole. Updates on knowledge can take various forms; therefore an evaluation of the needed changes is necessary.

To identify the changes needed to knowledge, the changes that happen to the environment on which the knowledge depends have to be identified first. This can be done by audits on the knowledge which can be performed regularly at specific intervals, or when specific indicators point out the possibility of outdated knowledge, like e.g. feedback.
## Table 7.1: Sub Process – Identification of Change

An evaluation of the impact of the change is undertaken to determine what kind of update is needed on what knowledge. This means identifying all affected knowledge packages as well as defining the type of change each of them requires.

<table>
<thead>
<tr>
<th>Input Links</th>
<th>Metrics taken or evaluated feedback can be utilized to identify changes with impact on knowledge.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activities</td>
<td>Identify a change having impact on knowledge.</td>
</tr>
<tr>
<td>Product</td>
<td>Identified changes requiring knowledge to change.</td>
</tr>
<tr>
<td>Output Links</td>
<td>The impact of the change is evaluated.</td>
</tr>
</tbody>
</table>

## Table 7.2: Sub Process – Evaluation of Change Impact

Knowledge updates can consist of discarding, joining, splitting or changing knowledge packages. Discarding denotes the deletion of a knowledge package from the active repository. Within deletion, the topic of archiving has to be taken into account. Splitting means that two different packages are made out of one that has been shown to
be too large. Joining denotes reversed splitting, i.e. putting two packages that have been
defined to be too small together into one.

An Issue

An issue that has to be dealt with is complexity. Although a general issue of conducting KM, the process-oriented view is nevertheless anticipated to be confusing when dealing with several knowledge domains. While knowledge domains are a means of splitting this complexity, the linking between them is important. KM can only be fully effective when knowledge flows are also enabled across organizational divisions or units, which are likely to be designed as separate knowledge domains. This can, however, be addressed by a KM role like a CKO, which has the responsibility for this issue.

7.4 Conclusion

The initial verification and validation activities as presented above are not enough to finally determine the usability of this model for different cases. However, they do prove that the model in its current state can be used with different scopes. Therefore, there is a need for further validation and verification activities to specify the cases in which the KM process model can be used and in which it probably cannot. The model, however, is to be considered an evolving means. That means that with the identification of situations that the model is not suitable for, modifications might become necessary. The resulting extended version of the model can then cope with such situations.

In its current state the model is quite abstract and, although pointing out what has to be done, does not in all cases provide enough help for the way things need to be done.
In applying the KM process model, therefore, external knowledge is needed. This affects a number of processes, such as:

- the analysis of knowledge culture and the according planning of culture goals, which, in order to be performed correctly, require that social and psychological sciences be taken into account.

- the determination of infrastructure, which is very important in today's often distributed environments or inter-organizational knowledge transfers when working close with external partners. At the same time it is difficult to support KM by technology, as there is a danger of placing too much emphasis on the technological issues and too little on the human factors. Consequently, there is a need for an analysis of applications that support KM properly and knowledge how to implement them into a KM strategy.

- the processes of knowledge creation, which often take place unconsciously and therefore utmost care should be taken in using this model.

This list is not necessarily complete. Knowledge Management is a difficult and complex topic and further needs for more explanation, addenda or corrections might come up. The suggested framework and model differs from other attempts to determine KM. Summing it up, the framework and model in its current state provides help in understanding knowledge acquisition in particular and knowledge management in general and provides assistance in conducting KM but requires additional knowledge about various aspects. It is a starting point and needs to be further developed to mature, including the provision of detailed knowledge on specific aspects as it contained in the related works.