Exploiting *Soft Systems Methodology* (SSM) and *Knowledge Types* to Facilitate Knowledge Capture Issues in a Web Site Environment

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Abstract

The building blocks of Knowledge Management include a range of activities, from the initial identification of knowledge goals to the maintenance and evaluation of knowledge repositories. An area of particular concern within the Knowledge Management cycle lies in the capture of knowledge. Soft issues such as cultural resistance and individual self-interest form considerable barriers to knowledge capture. Identifying the knowledge required for corporate knowledge portals, such as Web Sites, and highlighting the nature of the barriers to the capture of knowledge, is a major step towards successful knowledge capture. This paper illustrates how the Soft Systems Methodology (SSM) can be utilized to enhance the fuzzy, non-technical, issues surrounding the development of Web Site environments and, further, uses the concept of Knowledge Types to aid in the identification of knowledge.

1. Introduction

There are many reasons why an organization may wish to create a Web Site. A simple medium for advertising is one reason. The offer of full transaction facilities to customers, including the selection and payment of goods, is another. Alternatively, a Web Site could be created with the primary purpose of sharing knowledge. Examples of the latter include: a corporate Intranet; a public transport timetable; and a university Web Site.

Web Sites that are created with a view to knowledge sharing are problematic in a number of ways. First, there is the issue of what actually constitutes knowledge (Biggam [1]). For instance, what is the difference between opinion and knowledge and - given the medium and potential global audience - is knowledge culturally independent? Next, there is the difficulty of capturing this knowledge (Hislop [2]) and also codifying it (Whitley [3]). Will stakeholders readily release their knowledge? In what form will it appear? Will users understand it? Will personal goals conflict with organizational goals?

Although the creation of knowledge-sharing Web Sites also involves issues of importance other than knowledge definition and knowledge capture, such as security and the need for appropriate technical expertise, it is in the former areas that this paper concentrates. If an organization does not recognize what is knowledge or understands the barriers to knowledge capture, then a technically competent and secure Web Site will not compensate for a knowledge-sharing Web Site that fails to meet its primary function.

This paper will highlight knowledge identification and capture issues against the backdrop of a Virtual Learning Environment currently under development by Glasgow Caledonian University (GCU) and the Hong Kong Computer Institute (HKCI). This scheme involves an arrangement by GCU to capture staff knowledge (primarily in the form of lecture and seminar material) to be placed on a GCU Web Site (using a software facility called Blackboard) to be used by staff in Hong Kong to teach their local students.

Specifically, this paper addresses the following matters:

- Initial barriers to knowledge capture (knowledge definition, social and organizational barriers)
- Pointers to tackling these barriers

The application of the Soft Systems Methodology (SSM) will be applied to the GCU project to illustrate how knowledge capture issues can be clarified; in addition, the author will attempt to show how the use of *knowledge types* (the categorizing of knowledge) aids in
2. A Virtual Learning Environment: Real Problems

Sharing knowledge is not a new phenomenon. We all share knowledge, at different levels in society, to different degrees, wittingly and unwittingly, from the traffic warden providing directions to the lost motorist, to the university lecturer instructing students on algebraic theory. However, the aforementioned examples are simple knowledge-sharing scenarios: the main protagonists, although sharing their knowledge, are more correctly involved in knowledge-giving activities, i.e. there is little two-directional exchange of knowledge.

When genuine knowledge-sharing is introduced into a working environment, where colleagues are asked to share their expert knowledge, then, unlike the previous simple examples, practical barriers need to be recognized and overcome, examples of which include perceived loss of power (Davenport and Prusak [5]), lack of motivation (Nissen et al. [6]), inconsiderate use of language (Nelson & Cooprider [7]), resistance to change (Disterer [8]) and job insecurity (Brynjolfsson [9]).

Knowledge Management (KM) is an area where the literature is prolific and advice is eagerly sought, but the reality of closing the knowledge gap between theory and practice becomes only too evident when trying to implement a KM project (Bohm [10]). CommCo found this to their cost when they engaged in an ambitious plan to create a Cyberspace University (Scarborough). The purpose of this project was to integrate the company’s knowledge assets across its thirty campuses around the world.

CommCo listed as the main impetus for this global knowledge-sharing scheme the following reasons:

• Speed (quicker to create a Virtual learning Centre than to build a central global training center)
• Cost (reduces traveling costs and expenses linked to traditional teaching)
• Exploitation of Information Technology (no need for frequent face-to-face meetings)
• Effort to bring people closer together

Unfortunately, despite this laudable attempt by CommCo to realize KM theory for perfectly sound reasons, the project was eventually aborted. Reasons given for the collapse centred around major cultural barriers. In essence, the various CommCo stakeholders (senior management, regional managers, KM consultants, and HR consultants) reacted to the KM initiative in ways that protected their own interests. The following quotes (Scarborough, p.64) summarize their polarized positions:

‘Organisational change depends on a change of people’s behaviour. If we set up proactive performance measures, people’s behaviour will naturally change’ (Senior Management)

‘Our main task is to implement a knowledge process and establish a technological platform. The decline of this project is due to the fact that regional managers failed to perform their dual responsibility role’ (KM Consultants).

‘Our career depends on local business generation. Knowledge management and organizational change seem to us a luxurious management game’ (Regional Managers)

‘We don’t know what our role as change agents in the company actually is. We feel marginalized by the senior management and regional managers’ (HR Consultants)

The CommCo project, with different interests resulting in conflict and misunderstanding, illustrates that KM in practice is a field that requires sensitivity and understanding towards real management and staff concerns and pressures.

3. The GCU Virtual Learning Environment Project: Remit

The remit for the GCU staff team involved in the E-Learning collaborative scheme with the HKCI involved the franchising of the GCU post-graduate programme in E-Business to the HKCI. However, the quality and delivery of the programme was to be controlled by GCU staff in the Division of Business Information Management (the host department where the PgD E-Business resided).

The teaching team ordinarily involved in the delivery of the PgD E-Business at GCU, in effect, where given the task of placing their traditional teaching material, for the modules contained in the programme, onto a Virtual Learning Environment, to facilitate the delivery of their modules for local tutors in Hong Kong. GCU staff were also to visit Hong Kong to deliver parts of the module (part of the quality control).

The remit seemed straightforward if somewhat time-consuming, but the benefits were recognized by all the GCU teaching team: once their programme was placed on this Virtual Learning Environment, and if it proved successful, this model could be used again and again, in a variety of guises (with full-time students, evening students, distance-learning students, income-generation activities, etc.), each time minimizing staff effort and costs as well as allowing staff to concentrate on research activities to support their teaching and staff development.

Very quickly, however, issues appeared. These issues, despite a dedicated and well-meaning team, restricted the initial implementation of the project. The questions raised by the team members, via structured walk-throughs and e-mail communications, revolved around confusion about the specific detailed role of the GCU tutors and the nature
of the task to be completed. Given that the issues raised were soft issues involving matters of clarification, about what type of system was required, the use of the Soft Systems Methodology (SSM) was seen by some staff to be a suitable tool to clarify issues (it was also seen as an opportunity by staff familiar with SSM to use the E-Learning project as an example of SSM in use for students to study).

4. Using Soft Systems Methodology to ‘Enhance the Problem-Situation’

SSM was developed in the 1980s by Checkland [11] and Checkland and Scholes [12] as an alternative approach to dealing with aspects related to the development of information systems. Where the system issues were clear-cut and well-defined, then the solution could be derived through a technical methodology, such as SSADM (Ashworth and Goodland [13]). Where the system issues were unclear or fuzzy, then SSM was recommended as a means of clarifying the problems. In other words, SSM was not intended primarily as a means of producing technical solutions, but rather as a vehicle to facilitate the clarification of (softer) issues. Hence its suitability for use in the project at GCU.

SSM concentrates on stakeholder perspectives and thus facilitates user involvement, something that was very much needed at the early stages of the project. In addition, the tools used as part of the SSM methodology (CATWOE and Rich Pictures) are easy to employ and understand: this would allow continued participation of user groups. It was thought that the overall benefit of using SSM would be the facility to move from “the problem unstructured” to “the problem structured” to “desirable changes”, mirroring the stages of SSM.

This approach to systems analysis is well-suited to KM issues: too often the technical platform takes precedence over social and cultural issues and the ‘solution’ is assumed without much thought given to user requirements or stakeholder perspectives (Biggam and Hogarth). SSM emphasizes the need to understand stakeholder perspectives, through participative means (e.g. Rich Pictures) to, in the end, ‘enhance the problem situation’.

Users are an important group of stakeholders who have a critical role in the capture of user requirements. It ought to be emphasized that their value in the systems development process, particularly in the capture of user requirements, is not only recognized by Checkland but by researchers in other fields, e.g. computer security (Adams and Sasses [14]; Rannenberg [15]).

SSM has gone through various changes since its inception, but the SSM structure adopted for this E-Learning exercise was:

- **Stage 1: The Problem Situation Unstructured**
  - The initial requirements (production of lecture material, seminar notes, etc.) were issued and appeared to be straightforward. However, at an early stage, staff encountered some confusion.
  - The GCU teaching team knew that they were to transfer their specialist subject knowledge onto a Virtual Learning Environment, they were unsure of how each other was tackling the task (e.g. detailed lecture slides or outline lecture slides?) or, for example, what precisely was the role of the local Hong Kong tutor? In effect, it became clear that members of the teaching team interpreted the project differently.

- **Stage 2: The Problem Situation Expressed**
  - Two tools that are used in SSM to “enhance the problem situation” are CATWOE and Rich Pictures. Each aids in clarifying roles and issues. In the context of project, the use of CATWOE resulted in the following listing:
    - **C** Customers (i.e. beneficiaries of the E-Learning pack): HKCI, GCU
    - **A** Actors (i.e. those who carry out essential activities in the project):
      - GCU teaching team (development);
      - HKCI local tutors (delivery);
      - GCU teaching team (delivery);
    - **T** Transaction (i.e. change expected to take place):
      - Traditional PgD E-Business teaching material
      - PgD E-Business as an E-Learning pack
Weltanschauung (i.e. stakeholder perspectives):
See Rich Picture

Owners (i.e. person/group to whom PgD team are responsible):
GCU

Environment (i.e. environment in which relevant system is placed):
Virtual Learning Environment using Blackboard.

The use of CATWOE actually clarified a number of early matters. It became clear that the KM project team were required not only to produce the knowledge system but also participate in its delivery in Hong Kong. This then raised the question of what was to be delivered by GCU staff in Hong Kong (how many lectures/seminars?). At the start of the project, it became obvious, mainly through e-mail queries, that the GCU team viewed their role in different ways. The different perspectives, highlighted through the use of Rich Pictures, helped identify the misunderstandings over what was to be prepared by GCU staff (see below).

**Stage 2: The Rich Picture**

The Rich Picture produced was essentially a cartoon used to clarify delivery issues. This picture helped visualize a complex mess of interacting people, roles, threats, facts, observations, etc. Some of the elements of the Rich Picture are shown below:

*Figure 2. Rich Picture Element Expressing a Staff View*

> I’ll reproduce my lectures in note form and leave it for the local lecture to flesh out

*Figure 3. Rich Picture Element showing another staff view*

> My module is taught over a 12 week period, so I’ll provide 12 weeks’ worth of lectures/seminars

*Figure 4. Rich Picture Element showing another staff perspective*

> I’ll provide detailed lecture material, because the local HK staff might not understand my abbreviated notes, but I’ll take into account my visit to Hong Kong

Other issues were also highlighted:

Who owns this knowledge?
Should our use of language in our material be standardised?
How do we know that our knowledge, via lecture slides, etc, is interpreted successfully?
Is there not a question of making ourselves redundant?

**Stage 3: Define the System under Investigation**

Stage 3 was interpreted as developing the actual E-Learning teaching framework. The GCU tutors were asked to:

- Produce lecture material (on powerpoint slides)
- Structure seminar material to support the lectures
- Provide samples of previous assignments
- Indicate the necessary reading (books, journals, conference papers, web sites, etc.) to accompany lectures/seminars
- Set up a suitable communication facility between GCU and HKCI during local delivery
- Organize activities for the weekend visit by GCU staff
- Prepare and mark assignments; and
- Produce an overview of how each module was to be delivered

The software platform to act as the repository for all the above was an education software package called Blackboard.

The main tangible benefit of the final three stages in SSM (see Figure 1) resulted in a common collection of
templates, created on Blackboard, to be used by staff in the creation of their teaching and learning material. An example of the central teaching template is shown below:

Figure 6. Virtual Learning Environment template

5. Clarifying Knowledge through Knowledge Types

Although the use of SSM helped to clarify many soft issues, to properly grasp what type of knowledge was being used and transferred to the Virtual Learning Environment project, reference was made to the concept of knowledge Types.

Capturing knowledge is not an easy task. To begin with, one has to decide on what is knowledge. Although this may seem an artificial academic exercise, the benefits of considering what actually constitutes knowledge will be prove worthwhile.

But what is knowledge? For information to count as knowledge it must meet the following criteria (Hume [16]; Gibson [17]; Yolton [18]; Russell [19]; Locke 20; Descartes [21]):

- It must be true (to distinguish it from mere opinion)
- The perceiver must believe this to be the case (if the person acquiring knowledge has doubts then he cannot claim to know)
- Additionally, the perceiver must be in a position to know this to be the case (this is to counteract claims of, for example, brainwashing or blind faith: for instance, although at one time many people believed that the earth was flat, the fact was that they did not know this to be the case)

Knowledge is therefore a special kind of information. Importantly, the transfer of knowledge from one individual to another requires an active, thinking process, particularly from the receiver. In other words, knowledge is not something that can be given as one would a gift (if this were the case, then university students would all be scoring 100% in examinations).

How did this definition of knowledge aid GCU staff in capturing knowledge for their Virtual Learning Environment? The above definition raised a crucial issue in the project: if knowledge cannot be ‘given’ and involves active participation from stakeholders, then to depend on the lecture slides and seminar notes for the transfer of knowledge would therefore lead to failure. A process to facilitate knowledge transfer was therefore required to encourage HKCI staff/student participation and also monitor and test the extent of knowledge transfer.

This then led to a greater focus on the types of knowledge that staff have and the recognition that staff knowledge is more than powerpoint presentations or seminar notes (regardless of how well prepared).

Knowledge acquisition and representation are clearly crucial aspects of what constitutes a quality Web Site (Probst [23]; Fielding [24]; Schubert and Selz [25]; Barnes and Vidgen [26]).

How can the discipline of Knowledge Management (KM) help in the capture of knowledge for Web Sites? At a more detailed level, KM distinguishes between the main types of knowledge (Biggam [27]): Explicit, Organizational Static, External, Tacit, Personal, Dynamic, Internal.

These types can better be illustrated through the use of the following Knowledge Dichotomy Matrix, the purpose of which is group “knowledge opposites”:

<table>
<thead>
<tr>
<th>Tacit</th>
<th>Personal</th>
<th>Dynamic</th>
<th>Internal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organizational</td>
<td>V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Static</td>
<td></td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>External</td>
<td></td>
<td></td>
<td>V</td>
</tr>
</tbody>
</table>

Figure 7. Knowledge Dichotomy Matrix

The advantage of this matrix is that organizations can recognize the different types of knowledge that constitute their Web portals and so direct resources to capturing these different knowledge types. Further, by pairing knowledge types (e.g. Tacit v Explicit), there is the opportunity to appreciate that knowledge co-exists in
different guises. For instance, when GCU was attempting to ascertain the required knowledge to be contained on a Web-Site to facilitate their E-Learning project, the knowledge types (tacit v explicit, etc.) were related to different themes (such as Teaching Practice, Support Material, Supervision, etc.). The result was a rich picture of the knowledge needed to produce a successful distance-type learning package. Examples from Glasgow Caledonian University are detailed below:

**Knowledge Type**  
**Context: Teaching**  
Tacit  
v Explicit  
Personal  
v Organizational requirements  
Dynamic  
v Static  
Internal  
v External  
progression rates  

Thus, from the above simple matrix, it was recognized that: 1) teaching skills are important, so how do we transfer these skills via a Web-based environment?; 2) although the department has local knowledge of how local students react to different types of assessment, how do we find out how students on a distance-type learning programme react?

This process was developed within other distance-learning contexts such as Support Material, Supervision and Quality. On each occasion, valuable information was derived in terms of knowledge needed to underpin the HKCI programme.

In terms E-Business Web-Site development in general, it may be that the developers are interested in the knowledge that is needed to produce a quality Web Site. In this context, the key word is *quality*, and applying the Knowledge Dichotomy Matrix, at a simple level (because in reality there may be a number of iterations) might produce the following knowledge information:

**Knowledge Type**  
**Context: Quality**  
Tacit  
v Explicit  
Personal  
v Organizational  
Dynamic v Static  
Internal v External  

So, from the above matrix, if an organization was trying to find out who were the best people to create their Web-Site, then they may check for those staff who have recently attended training programmes (explicit knowledge) or, alternatively, they may ascertain local advice from individual departments (because some of the best people may not be formally trained but still possess admirable skills). In addition, the organization may wish to that certain legal constraints are accommodated (e.g. national versions of the E.U. Data Protection Act) and the knowledge required to implement the security may be confined to a number of individuals (organizational v personal). Steps therefore need to be taken to ensure that both knowledge-types are working in tandem.

The above procedure is a relatively simple exercise, but it can sometimes lead to confusion between knowledge-types, particularly in the initial stages of completing the matrix. For example, there may be occasions when the differences between *tacit* and *personal* and *internal* are difficult to delineate. The key to tackling this problem is to concentrate on the knowledge pairs, i.e. *tacit* knowledge is linked to *explicit* knowledge, *personal* to *organisational*, etc. In other words, do not compare *tacit*, *personal* and *internal* knowledge with each other, but with their knowledge opposites. Even then, there maybe occasions were pairs of knowledge opposite entries are almost interchangeable without loss to meaning. In this case, it is the knowledge that is captured that is important, and any questions that result, not the technical ability to complete the matrix “properly”.

Another issue that may arise is that the knowledge pairs may have more than one entry pair. This is to be expected. For example, in the Glasgow Caledonian University study, in the context of Teaching it was found that there were a number of entries for *personal v organisational* knowledge: subject knowledge, module topic requirements; module resource requirements, resources available; appropriate assessment instruments, assessment requirements; recommended reading, support finances available; etc. In each case, questions were raised on how to ensure that organisational knowledge of Teaching issues were appropriately dove-tailed with personal knowledge of Teaching.

**6. Conclusion**

Knowledge capture is not a simple task. This view is supported by many researchers involved in the world of Information Systems Development when they often highlight the failure to capture user requirements as a root cause of systems failure. The younger field of Knowledge Management is no different in that respect. However, there are tools and techniques available that can aid the process of knowledge capture. Hopefully the use of SSM as a means to clarify fuzzy requirements issues and the application of Knowledge Types to categorize the different types of knowledge, highlighted through the GCU Virtual Learning Environment scheme, can
contribute in some small way towards the complex, social maze of knowledge capture issues. However, it must be recognized that clarifying issues is not the same as solving the problems, but it is a start. Indeed, an interesting area of further study would be to use SSM and Knowledge Types as part of the ‘stage model’ proposed by Lee et al [28] to integrate the building blocks of Knowledge Management.

7. Bibliography


