



Knowledge Re-Use Situations in an Enterprise Systems Context

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ABSTRACT

Following disappointing knowledge capture outcomes during implementation and the consequential inability to effectively re-use that knowledge, information systems managers are recognizing the importance of lifecycle knowledge management as they face the first major upgrade of their organizational enterprise systems. A qualitative study in an Enterprise Systems Application Service Provider provides support for Markus' Theory of Knowledge Re-use. An extension to Markus' typology of Primary Data Miner is proposed to explain management's dominant knowledge re-use situations.

INTRODUCTION

In her paper Markus (2001) proposes a Theory of Knowledge Re-use based on published accounts of situations involving the creation and use of written and computer-based records for the preservation, future access and re-using of knowledge. This study tests Markus' Theory in an organization that provides enterprise systems application service provision (ASP) to five state government agencies in Australia.

Following the spate of Enterprise Systems (ES) implementations prior to the turn of the century, we now find several organizations facing their first major systems upgrade since deployment. The extent and cost of these major upgrades can match or exceed the initial implementation and management is beginning to appreciate the need to recall their lessons and practices from these initial projects. In effect they are acknowledging the potential value of re-using procedural, declarative and rationale knowledge (Zack, 1999) from these earlier implementations.

This study forms part of a research program entitled "Enterprise Resource Planning (ERP) Lifecycle Knowledge Management" (Gable et al, 1998). A central premise of this work is that an organization's ES knowledge management / sourcing strategy effects knowledge requirements in later lifecycle phases. Effective ES knowledge management is considered to offer significant commercial and practical benefits throughout the ES lifecycle (Gable et al, 1998). Within this research program, a recent major issue study involving the application service provider and their clients (Chang, 2000a; Chang, 2000b) identified knowledge management as a top ES lifecycle issue in this context. The purpose of the study is to test Markus' theory within this context, and in doing so, to inform academe and practitioners on ways to improve knowledge management in the ES lifecycle in general and the upgrade process in particular.

The research method entails a comprehensive, qualitative case study of employees in the ASP using semi-structured interviews based on the theoretical framework presented by Markus. From these interviews the researchers determine the dominant knowledge re-use situation in each employee's role.

This research paper has two aims: 1) To confirm or otherwise Markus' knowledge re-use typology; and 2) To explore the commonality of dominant knowledge re-use types in employee groups.

The results from this research provide confirmation of Markus' work. To provide an explanation of knowledge re-use by management we propose an extension to her typology. The study also uncovers several interesting knowledge dynamics of the subject ES upgrade project team. In this paper we first describe the Enterprise Systems context. We then outline Markus' underlying concepts and knowledge re-use typology. Following a description of the case subject and methodology, we discuss the results and applicability of Markus' theory in this context. Finally we note some additional interesting findings arising from the study and submit our conclusions.

THE ENTERPRISE SYSTEMS CONTEXT

Davenport (2000) posits that organizations regard an ES project as a one-time exercise and so fail to attend to ES knowledge management issues, such as requesting (contracting for) knowledge transfers from consultants, or adequately maintaining the transferred knowledge. His expectation is that knowledge transfers leave the client organization better positioned to maintain and evolve their system and to generate returns from the ES investment.

According to Chan (1999; Chan & Rosemann, 2001), ES implementations require a wide range of knowledge including project knowledge, technical knowledge, product knowledge, business knowledge and company-specific knowledge. Where an organization does not have the requisite expertise, it will seek knowledge-based resources from third-party providers such as consulting firms (knowledge vendors), which act in the capacity of implementation partner (Timbrell & Gable, 2001; Timbrell et al, 2001).

Following completion of an ES implementation, the implementation partner usually withdraws from the organization and responsibility for managing the ES falls back to the client. Continuing success of the ES becomes reliant on the client's skill and knowledge in running, supporting, maintaining and upgrading the ES. In order to keep the ES 'live' and relevant, the client must draw from their ES capabilities transferred-in during the implementation period, develop them internally or seek expert support (knowledge) externally. Such external support is usually available from the vendor, the implementation partner and other third parties, and is often expensive (Timbrell & Gable, 2001).

Self-sufficiency is the knowledge objective of an internal ES and indeed most support functions. Where the client plans to outsource its ES to an Application Service Provider (ASP), the need for post-implementation, ES, knowledge self-sufficiency reduces for that organization. ASP vendors cite this alleviation of 'future skills risk' as one of their competitive advantages (Bennett & Timbrell, 2000). Responsibility for most of the project, technical and product knowledge management transfers to the ASP.

To achieve operative, internal, ES, knowledge self-sufficiency, the ES team must, inter alia, systemically identify, qualify, and record ES knowledge for later re-use by themselves, their successors and relevant others in their organization. This context provides a suitable opportunity to test Markus' theory of knowledge re-use.

MARKUS' UNDERLYING CONCEPTS

The underlying concepts in Markus' (2001) framework are: knowledge re-user and the purpose of knowledge re-use; what the recipient needs to know, knows, and doesn't know, and challenges the recipient faces at each stage of knowledge re-use: question definition; document / expert location; document / expert selection; and knowledge application. The roles in her framework are the knowledge producer: the originator or documenter of the knowledge; knowledge in-

termediary: those who prepare the knowledge for re-use; and the knowledge consumer: who retrieves the knowledge and applies it in some way. It is important to note that the same individual or group or different individuals or groups or some combination can perform the three roles. In defining different situations in which knowledge is re-used (i.e. knowledge re-use situations) the differentiating characteristics are the 'knowledge distance' (measured in terms of knowledge redundancy between the producer and re-user) and the purposes of re-use. Markus' dependent variable is successful knowledge transfer and re-use.

The resultant typology arising from these concepts and characteristics includes four types of knowledge re-use situations: shared knowledge producers, shared knowledge practitioners, expert-seeking novices and secondary data miners.

Table 1: Markus knowledge re-use typology

Shared Work Producers	Closest in knowledge distance, they produce knowledge for their own later consumption while working on a shared work product either as a homogeneous work group or a cross-functional team. An example is an ES implementation team revisiting design decisions later in the project
Shared Work Practitioners	Sharing a community of practice, knowledge is produced by specialists who occupy the same role in different locations such as consultants in the ES practice area. They produce knowledge for each other to use and frequently rely on networks to assist them locate documents or experts.
Expert-Seeking Novices	Furthest in knowledge distance, this type has potentially the greatest difficulty in all phases of knowledge re-use situations such as defining the questions, locating and judging the quality of the knowledge sources and applying the expertise.
Secondary data miners	Completely divorced from the knowledge producers, they apply analytical expertise to extract knowledge from repositories. Their rationale for knowledge re-use may differ significantly to that which initially motivated the knowledge explication by the producer.

The four knowledge re-use situations are described above. Markus notes that the situations involve individuals or groups and those same individuals / groups may trigger or effect different knowledge re-use situations as their knowledge distance or purpose of re-use varies.

BACKGROUND AND METHODOLOGY

In this study, the ASP studied has five government agencies as clients. In 1998, the ASP coordinated the simultaneous implementation of SAP R/3 in these five agencies. Three and a half years later, the ASP is coordinating the first major upgrade across its entire client base. To assist in the implementation the ASP employed a major international consulting company. For the upgrade process, however, the general manager believes his organization is experienced enough to execute the upgrade with the assistance of a few key individual contractors. He also recognizes the importance of knowledge access, capture and re-use both for the current upgrade process and future upgrades.

In 1999 a survey was conducted of major issues in the planning, implementation and ongoing management of the SAP R/3 systems established under the guidance of the ASP. The results of this survey positioned knowledge management as a major concern for both strategic management and operational staff. In order to study this finding in further depth and to capture rich contextual evidence available, the research team decided on a case study approach using semi-structured interviews based on a prepared case protocol.

All twenty-eight employees within the ASP were interviewed over a six-day period. Two tape transcripts were unusable. The semi-structured interview firstly established their role and how long they have spent in that role. Instances of their knowledge re-use situations were explored during which the interviewer referred to and confirmed the specific characteristics of these knowledge re-use situations according to Markus' theory. From the transcripts, a determination of the dominant knowledge re-use situation experienced by the employee was made and is listed in Table 2.

DISCUSSION

The first observation arising from the interviews is that all employees experienced more than one type of knowledge re-use situation with many employees experiencing all types. This is consistent with Markus' expectations. Depending on the situation an employee that is dominantly exhibiting shared work producer knowledge re-use characteristics might become an expert-seeking novice under differing circumstances. Yet each employee tended towards a natural or dominant application of knowledge re-use.

Another observation was that certain groups showed a commonality of knowledge re-use situations. Help desk employees (except for one member) prevalently displayed Shared Work Producer characteristics. This is consistent with Markus' framework. She posits that the purpose of knowledge re-use for the Shared Work Producer is to 'keep track of current status and things needing attention' or to 'recall reasons for decisions when decisions need to be revisited'. Consistent with Markus' characteristics of Shared Work Producers, one help desk member commented that he

"...doesn't believe that anybody else outside the three member team would be interested in re-using our knowledge except maybe for statistical purposes"

Table 2: Dominant knowledge re-use situation

Type	Role	Years in role
Shared Work Producer	Help desk supervisor	4
	Help Desk	6
	Help Desk	1.25
	Help Desk	3
	Business Analyst	3
Shared Work Practitioner	Business Analyst	2.5
	Business Analyst	3
	Business Analyst	27
	Upgrade Project Team Leader (C)	0.25*
	ABAP programmer (C)	0.25*
	ABAP Programmer (C)	0.25*
	Intranet developer	4.5
	Intranet developer	3
	Systems Admin	2
	Systems Admin	1
	Systems Admin	3
Help Desk	1	
Expert-seeking novice	Business Analyst	0.25
Secondary data miner	General Manager	8
	Systems Operations Manager	3
	Development Manager	2.5
	Principal Bus Analyst	3
	Senior Business Analyst	3
	Business Analyst	9
	Business Analyst	2
	Project Officer (Bus analyst support)	0.75

* The three contractors each have approximately six years SAP experience in various technical roles across several clients.

The single help desk member whose dominant knowledge re-use typology was a Shared Work Practitioner was originally a contractor who took up a permanent position with the ASP. She is a very experienced help desk operator having worked on several other help desks previously. Having access to personal contacts that can assist her in solving technical enquiries, this employee ranges outside the homogeneous team to 'acquire new knowledge that others have generated'. She, in accordance with Markus' Shared Work Practitioners' characteristics, will 'get advice about how to handle a particularly challenging or unusual situation that is new to the team from other similar practitioners in other geographic locations.

Other Shared Work Practitioners included the systems administration staff, technical developers, the two ABAP (proprietary SAP development language) programmers (both contractors), the upgrade project team leader (a contractor) and some business analysts. One of the business analysts of this group summarized the modus operandi of this group:

"...if I can't find the right expert or expertise in-house I use my personal network contacts."

Each shared work practitioner both has and uses their personal networks as a major source of technical knowledge in the enterprise systems context. In particular the contractors each have a network that they can call upon when faced with a challenging or difficult problem. This network increases in quality and range as they work in different organizations. Interestingly, the general manager believes that the use of informal networks "are more prevalent in the key staff" and is generally unaware of the importance and reliance of these operational technical knowledge workers on their personal connections.

The single expert-seeking novice in the group was a newly recruited graduate with little prior business experience. As a junior or trainee business analyst he is learning his trade and tends to ask arcane questions during that process. When talking about the formal repository he mentioned he

"...only stumbled across the existence of the database. Nobody told me it existed."

The only other instances of Expert-Seeking Novices knowledge re-use was not unexpectedly reported by a help desk operative who, in describing help desk calls, noted that

"...most people just want a quick solution without needing a rationale."

The group that dominantly exhibited the typology of Secondary Data Miners consisted of management and the senior business analysts. The 'knowledge distance' of this group from the knowledge producers is closer than what is suggested in the typology, yet the characteristics of their principal knowledge re-use situations fitted this category. Markus tends to describe a 'data miner' more in the nature of an independent researcher or organizational 'outsider'. The case evidence implies, however, that management, using their advanced analytical skills, re-uses organizational knowledge in accordance with Markus' definition for the secondary data miner category i.e. 'to answer new questions or develop new knowledge through analysis of records produced by others for different purposes'. The researchers conclude that an additional knowledge re-use situation arises when management mines organizational data to analyze productivity, discover new or confirm intuitive trends and developments, or manage knowledge content and quality. An appropriate label for this typology is Primary Data Miner.

OTHER GENERAL OBSERVATIONS

Some other interesting observations were made within this study that are relevant to the knowledge management of the ES lifecycle and could be worthy of further investigation.

Management generally regarded knowledge capture during the initial implementation as a failure. The Principal Business Analyst noted that

"...the initial required knowledge from the implementation is gone and irrecoverable likening it to 'sand slipping through fingers.'"

Following disappointing knowledge capture outcomes during implementation and the consequential inability to effectively re-use that knowledge, the General Manager has instigated a strategy for capturing and recording the current upgrade processes to support future upgrade projects. In particular he wants to capture the specialized knowledge of the contractors. To achieve this goal he initiated 'knowledge transfer sessions' however after some trials he noted "staff were not enthusiastic about these and perceived them as a waste of time". Additionally he introduced a knowledge database with the clear intention that it becomes a repository for ES upgrade knowledge and believes this knowledge strategy to be effective. From the interviews we discovered that contractors did not believe they had write access to the knowledge database and so did not make any contributions to the database. Furthermore, they tended to make personal records for their own re-use in future contracts and did not demonstrate a disposition for creating documentation for the future re-use of their clients.

Secondly, those experts who were proficient in a previous ES (in this case Dun & Bradstreet) were assumed to carry that proficiency into the new system (SAP R/3). This assumption is made about help desk personnel and leading technical experts. This may be supported by the implementation strategy of "technology swap" whereby the processes and reporting of the old system is implemented in the new system. One proponent of "technology swap" defended it by saying "For established procedures there is already a rationale so therefore it's easier to adapt a new system to these established procedures."

Intimate knowledge of the application of the old software to these (consistent) processes is seen to be an advantage in building expertise in the application of the new system to these processes.

And finally if you are inexperienced in the organization then the initial knowledge source is the normal organizational role for that knowledge domain but if you are experienced then the formal job titles become less important and the real expert status is derived from experience of successful past interactions. This is consistent with other research findings, in example, Andrews and Delahaye (2000).

CONCLUSIONS

Overall the study supports Markus' Theory of Knowledge Re-use within the context of the ES lifecycle. Workgroups showed consistency in their dominant re-use typology. An extension to Markus' typology of Primary Data Miner is proposed to explain management's dominant knowledge re-use situations. The findings also reveal the prevalence of informal networks in the ES context and their important role in ES lifecycle knowledge re-use.

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