Knowledge Integration: Learning from the Millennium Bug Experience A Case Study of NatWest Bank Global Financial Markets

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Abstract- **Despite the enormous media coverage that the issue of year 2000 (Y2K) readiness has received in recent months, the focus of that coverage has been restricted almost exclusively to technological aspects. Non-technical issues have tended to be either ignored completely or given very little attention. Most importantly, not much is known about the organisational processes of preparing to face this vitally important challenge. A case study of NatWest Global Financial Markets' (GFM) Y2K programme was conducted to analyse its main features and lessons. The research concludes that, if applied properly, such lessons can be used to contribute to post-millennium business growth. In particular, in this study, the importance of penetrating functional boundaries, building shared perspectives and reconfiguring organisational memory is highlighted.**

I. INTRODUCTION

The year 2000 (Y2K) problem has arisen because 1960s and 1970s computer programmers designed programmes using only two digits to represent the year (in both software and hardware) in order to lower computer storage costs [1, 2] and other technical reasons [3]. Despite the enormous amount of media coverage that the issue of Y2K readiness has received in recent months, the focus of that coverage has been restricted almost exclusively to the technological aspects [4, 5, 6, 7]. Non-technical issues have tended to be either ignored completely or given very little attention. Most importantly, there are relatively few studies that have provided detailed descriptions on the process by which organisations

organise, prepare and test their Y2K compliance. The reason for this neglect appears to be the belief that the Y2K project is a unique, one-time event and that no long-term added value can be derived from the experience. The aim of this case analysis is to dispute this belief. In order to do that, the Y2K programme in the particular case company (NatWest Global Financial Markets (GFM)) is considered from the perspective of knowledge integration. Knowledge integration is defined by this study as 'an ongoing collective process of constructing, articulating and redefining shared belief through the social interaction of organisational members'.

The Y2K programme to be described involved virtually every member of staff in the organisation. Thus, even though the programme was led by a London-based team it involved every branch of the bank world-wide. The number of systems used, the number of people involved, the length of time required, as well as the dispersion of participants, all pointed to a project on a much larger scale than any one previously undertaken in the bank. The study concludes that the experience of the Y2K Programme demonstrated GFM's capability in integrating knowledge on a global scale. Based on the findings, the study suggests that the Y2K problem is not merely a technological issue, but at root, a socio-technical problem. As such, its solution requires a comprehensive understanding of organisational processes as well as technological skills. The main challenge is posed not simply by the technological

solution itself, but by the daunting task of implementing this solution throughout the bank, in particular across all overseas branches. This task requires the organisation to integrate its functional-specific and discipline-dependent knowledge on a global scale [8].

Based on GFM's experience in managing the Y2K programme, this study articulates three processes that appeared to contribute to effective knowledge-integration: (1) penetrating different boundaries to obtain required knowledge; (2) disclosing different paradigms to achieve shared understanding; (3) refining organisational memory to create new knowledge. While the Y2K programme at GFM was the largest undertaken within the bank to date, such global IT projects are increasingly common, as indicated by the increase in popularity of ERP implementations. This suggests that, where IT projects need to integrate knowledge and expertise from multiple, widely (even globally dispersed) sources, the experiences and lessons gained from the Y2K programme are potentially beneficial. This case study, then suggests that experiences in organising a Y2K programme can, potentially, provide valuable learning that could be useful for future IT innovation projects where knowledge integration on a global scale is central. It is argued that, if the experience can be articulated and applied, such lessons can be used to contribute to post-millennium business growth [9]. In other words, this study sees the experience of the Y2K preparation process as "*an investment in future performance, and in long-term business performance and financial goals*" [10].

In terms of method, several approaches were employed for data collection. The primary sources of data are sixteen semi-structured interviews which were conducted during March and April 1999. Sixteen interviewees were selected from various management levels as well as different business functions. In terms of business functions, interviewees are from technology, architecture, risk and finance technology, interest rate derivatives, global money markets, human resource, strategy, programme management and operations. On top of the sixteen interviews, additional information was collected through discussions with overseas team members via telephone and email between March and September 1999. Four meetings with team members and other participants were held during September 1999 and February 2000. A follow up interview with the team leader was conducted in February 2000. Secondary data, drawn from internal documents,

meetings and a three week on-site observation, were used to compliment and enhance the data collected from interviews.

The paper is divided into four parts. Following the introduction, Section 2 presents the case study of NatWest GFM, with an emphasis on the background information of the case company and Y2K programme. Section 3 provides the analysis and considers the lessons that were learnt in the process. Section 4 summarises the main theoretical and managerial implications of the study.

II. CASE STUDY- NATWEST GFM

A. *Company Background*

The case company, NatWest Global Financial Markets (GFM), was formed in 1997 as part of the NatWest Group. NatWest GFM provides financial products ranging from foreign exchange and currency options to interest rate derivatives, and has operations in financial capitals such as London, New York, Singapore and Tokyo. Globally, 1,100 employees produced £393 million profits before tax in 1998, an increase of 61% compared with 1997. According to NatWest GFM's organisational chart, the company's structure is composed of various departments such as Technology, Business, Infrastructure, Human Resource, Research and Finance. However, an alternative way to understand the organisational structure is through GFM's financial product ranges. Each product range has its own staff, including traders and technologists, with hierarchical relationships through which reporting lines are laid and responsibilities are delegated.

B. *The Millennium Programme: Background, Coverage and Process*

Under regulations established by the Bank of England and IMRO, every bank in the UK must ensure that all its systems are millennium-compliant and that there will be continuity of business operation should any unforeseen millennium crisis occur. NatWest GFM initiated its millennium programme, GMP, in 1997 and expects it to end in March 2000. During 1998, the GMP programme has primarily focused on areas including IT applications; IT infrastructure; end user computing; premises; and managing client and regulator enquiries. More specifically, the major tasks of the millennium compliance are threefold:

- to identify all individual systems used in NatWest GFM;

- to map interrelationships amongst various systems including those networked with other parts of NatWest Group and other financial institutions; and
- to test and prove that these systems are millennium compliant.

The second stage of the GMP, started in 1999 and aimed to address non-compliant situations and shift effort from becoming compliant, to maintaining compliance, as well as monitoring clients' millennium preparations and individual credit policies. Other initiatives, that were part of the GMP, included millennium business continuity planning, millennium rollover planning, contract reviews and external testing. Specifically, business continuity is required to ensure that the business can still function continuously even if disasters occur. The three major tasks of business continuity are:
- to identify processes through which the business functions;
- to formulate alternative options to sustain business activities such as an alternative site, manual tools and possible actions; and
- to ensure that every employee in NatWest GFM knows what to do should a crisis occur.

C. The Diversity and Complexity of IT

The IT employed in day-to-day business varies not only from the front, middle to back office, but also from product to product. In addition to office- and product-specific systems, there are systems which network these three offices for various products. For example, various inter-organisational systems are used. IT and systems developed in-house or acquired externally are numerous and diverse. As explained above, one of the primary objectives of the GMP is to identify existing systems, their interrelationships and to test their millennium compliance. In order to fulfil such objectives, London based team members, teamed up with other domestic and overseas members, are required to identify the systems, their users, and the uses to which they are put in terms of business functions. To gather such information, these members need to have a background knowledge not only of technology but also of the business. The resulting information and lessons are codified into a centralised database. This however is merely the first step of the implementation processes.

Systems with standard applications were developed and modified gradually by the joint efforts of the end

users and the technologists. Handbooks provided by the software house, according to some informants, could no longer provide valid information on such systems. For custom-built systems, developers and end users are the only people with the necessary knowledge of such systems in terms of their application and development process. The GMP members were required to articulate this knowledge by interacting with developers and end users. Moreover, the modification of systems is an ongoing process. Therefore, even though a system is millennium-compliant, a constant effort is still required to maintain the compliant status. Thus, constant interaction with the developers and the users is vital if the GMP team members are to keep on track with system modification.

III. ANALYSIS AND LESSONS LEARNED

The purpose of this case study was to examine the mechanisms by which functional-specific knowledge is integrated during the process of implementing a Y2K programme. Three lessons emerge from this study which are analysed below: (1) penetrating three interrelated types of boundaries; (2) building shared perspectives; (3) reconfiguring organisational memory.

A. Penetrating Boundaries

This mechanism refers to the process by which project team members break through various boundaries in order to acquire the necessary knowledge for the programme. Various types of boundaries that inhibit cross-functional knowledge integration were often found in the communication process which took place cross-functionally. Interviewees suggested that both top-down and bottom-up communications in GFM are efficient and open. At the same time several informants indicated that major problems occurred where collaboration was needed which involved communication across functional boundaries ('silos' as one interviewee described it).

"Individual managers who are three layers down have gone around the organisation and tried to implement the change, because they were told to do so by their boss. The manager himself was going around to make the changes has been beaten, abused and demoralised by not getting the support of his peer group and his boss's peer group."

As is evident in the case, boundaries found in the communication process are not merely created by formal organisational structures. They also originate

from the differences in organisational subcultures and the context in which the knowledge is constructed. Interrelationships between these boundaries indicate that the formal organisational structure, in particular the dispersion of organisational units around the globe, inspires the development of distinctive subcultures. Subcultural differences are further reflected in the differences in knowledge as socially embedded and functionally specific [11]. Hence, it is clear from the argument that the penetrating process involves not only overcoming departmental barriers, but also subcultural and knowledge barriers.

In terms of penetrating departmental boundary, evidence from the case suggests that legitimate power does not always appear to be the most appropriate approach in penetrating departmental and subcultural boundaries. As one of the team members stated: "you can't just tell them that 'because Stephan Harris (CEO of NatWest GFM) wants you to do it, so you have to do it' ... It is like asking them to do you a favour." Instead, the team members argued that trust was one of the most important issues, in particular 'companion trust' as argued by Newell and Swan [12].

Additionally, evidence found in the study suggests that organisational subculture as a contextual issue became one of the boundaries which separated people who participated in the knowledge construction process and those who did not. Its implication to cross-functional knowledge integration is that organisational subculture creates a barrier that restrains communication and knowledge sharing. Also, this points out that knowledge itself constructed in a specific subcultural context can create a boundary inhibiting people with different subcultural backgrounds from understanding it.

The penetration of the knowledge boundary was equally vital. Knowledge required by the programme is invariably dispersed within the organisation [13] and exists in various forms [14, 15]. It is enclosed and often concealed by departmental or functional boundaries, reflecting the stickiness and embeddedness of knowledge [16, 17]. In the case study organisation, the team members penetrated into each function not only to gain collaboration and support, but also to identify what knowledge was needed, who possessed it, and how such knowledge could be externalised and codified. The transferability and communicability of knowledge directly affects the process as well as the outcome of such a boundary-penetrating process. In particular, in the

case of tacit knowledge, team members need to be equipped not only with the skill to absorb it, but also with the experience of helping participants to articulate and externalise it.

The concept of knowledge redundancy argued by Nonaka [18] has become one of the critical issues which explains why and how team members are able to penetrate the boundary of knowledge. Having some background knowledge in business and technology has eased the team members in communicating with the technologists and the end users in the business and articulating knowledge from them. It is clear that such redundancy can be created during the recruiting process by selecting team members with sufficient background knowledge to overlap with other programme participants.

Another vital function of boundary penetrating is to enable team members to sustain project awareness by making possible continuous communication with various business functions. Furthermore, by gaining the collaboration and support of end users in different business functions, team members are given the opportunity to understand other parties' attitudes and to exchange ideas.

B. Building a Shared Perspective

This mechanism refers to the process by which participating parties create overlaps between different perspectives, attitudes and perceptions, and build a shared understanding of the knowledge assets created during the Y2K project. Despite the fact that most of the team members had some background knowledge in technology and business, the challenge to obtain required knowledge from the technologists and users was substantial.

Firstly, systems had often been modified through the collective efforts of technologists and users. It was often difficult for either party to explain why these modifications had been undertaken and yet this understanding was necessary so that the project team could understand the rationale of the system. This can be explained by the low degree of knowledge redundancy [18] between these two groups of organisational members. Additionally, this can be explained by the concept of paradigm suggested by Kuhn [19] who argued that each scientific community has its own distinctive paradigm which refers to shared examples, core values and a particular mindset. Paradigmatic differences between

the technologists and the end users in the business clearly illustrate the challenges faced by the GMP team as the difficulties to build a shared understanding amongst different communities.

Secondly, most of the modifications had occurred through day-to-day operations and had often not been codified. Thirdly, to educate users about the technological importance of millennium compliance and to get technologists to understand the business issues surrounding the Y2K problem was seen as very difficult by the project team members. In other words, people in the business function and technology function do not have sufficient knowledge to understand each other's need. This problem is a more generic problem in the investment banking industry (and probably other industries). As explained by the Managing Director:

'Technology in its own right is a very interesting business. But to be a technologist who understands investment banking and understands where you need to build is incredibly difficult. The real issue installing technology is that users don't really know what they want. So the traditional model of business requirement, design, develop, test, and implement doesn't work in investment banking'.

Hence, the team members needed not only interpersonal skills to gain sufficient time from technologists and users, but also the ability to facilitate dialogue among and between these groups to constantly clarify the information collected. More importantly, this process of ongoing dialogue helped to create a shared understanding amongst all members of staff about the technological and business imperative of the Y2K programme. Boland and Tenkasi [20] use the term 'perspective' to indicate the paradigm held by a particular community. Based on the argument of Boland and Tenkasi, it is proposed that by understanding different perspectives or even building a new perspective between participating parties, new knowledge is generated. In this case, it is evident that through initial contact with the end users, team members not only exploit end users' perspectives but also demonstrate the team's perspective to the end users. By showing each party's concerns as well as negotiating an acceptable way forward, both parties are able to exchange their perspectives. By so doing, end users were able to understand the needs of the team as well as the potential benefits they could gain from the project. It is believed that by the exchange of perspectives between the two parties, intellectual buy-in can be achieved.

The findings of this study suggest that during the process of implementation, the GMP team constantly engaged with different paradigms. As already explained, by penetrating functional boundaries and removing communication barriers, team members were able to obtain the required information and knowledge. By continuous interaction with project participants, either the technologists or the end users, they were able to maintain project priority and ensure the survival of the project. However, the case also suggests that merely acquiring the required information and knowledge from other business functions is not sufficient to trigger knowledge-integration across functions. It is evident from this study that a shared understanding can only be achieved through the disclosure, exchange and expansion of different perspectives and paradigms, as in the concept of perspective taking and perspective making indicated by Boland and Tenkasi [20].

Based on the findings, it is manifest that the essence of perspective taking and perspective making is not merely limited to the building of shared understanding at the intellectual level. Equally vital, it is the contribution to the formation of shared understanding at the intellectual level through mutual acceptance and appreciation between the participating parties. "*Emotional alignment*" [21], as the ultimate product of such a process, sanctions the achievement of emotional buy-in. It is observed in this study that by taking, making and sharing perspectives between various parties, the paradigm held by each party can be expanded. Furthermore, the alignment between different paradigms can produce beneficial outcomes to the project by facilitating the social interaction between the participants.

Furthermore, it is observed in this study that by penetrating various functional boundaries, team members were able to obtain knowledge and information from end users and thus gradually built up their understanding about how each business unit worked. It is also understood that by interacting with and receiving feedback from team members, end users constantly updated their understanding about the project in addition to their day-to-day work. It was evident that through this mutual learning process, team members and end users were able to build up a shared understanding of the project, and were thus able to understand each other's paradigm intellectually and to appreciate it emotionally.

C. Reconfiguring Organisational Memory

The concept of 'reconfiguring organisational memory' refers to the process by which existing knowledge assets accumulated by the organisation are challenged, cultivated, added to and renewed gradually through the progress of the project. Similar concepts can be found in knowledge base and organisational memory studies [22]. In particular, the notion of organisational memory is used here to explain that the existence of knowledge architecture is not diminished, but enhanced and stimulated, by the replacement of organisational members [22, 23, 24].

For a project with an organisation-wide coverage, reconfiguring organisational memory is a process to which all participants contribute collectively. In the case study, despite the fact that the GMP team played the leading role in the implementation of the project, the project team did not solely lead the organisational memory reconfiguration process. Participants from various business units constantly engaged in such processes by bringing in their beliefs as well as by confronting the different ideas possessed by others.

According to the literature, organisational memory exists in various forms and is developed by various approaches [22, 25]. It is particularly apparent in this study that the GMP Team has placed a great deal of emphasis on refining organisational working practice and establishing a database. Based on previous experience of what would work and what would not work, the GMP Team, in particular the leader, adopted certain approaches and discarded others. Clearly, to make such a decision in a group context was a complicated process. To achieve intellectual buy-in, as discussed earlier, the team had to explain why it had adopted certain approaches. Through this process of confronting and challenging, and by getting the approval of participants, existing working procedures were refined by the team and spread out through the organisation. For instance, to have a standard procedure applied to the global operation rather than allowing domestic variance was recognised by the team leader as essential to ensure that there was the same quality applied across all branches world-wide.

Additionally, this study found that the enrolment of new members influenced the process of organisational memory reconfiguration. By bringing in expertise and experience from other organisations, new members were encouraged to propose different ways of working to the team. Through the modification and refinement of existing working procedures, new team members further contributed to the reconfiguration of organisational memory.

Lessons and knowledge articulated during the implementation process not only benefited individual participants. They also contributed to the accumulation of knowledge assets at the organisational level by gradually reconfiguring its memory. Evidence was found in some initiatives taken by the organisation after the implementation of the Y2K programme. For instance, subcultural boundaries faced during the implementation process triggered the organisation to examine the influence of subcultural differences in its global operation and to initiate a cultural change programme. Additionally, the approach towards IT change and IT management has been altered based on the lessons learnt from the Y2K programme. The team leader stated that GFM had previously concentrated primarily on the speed of IT development without paying much attention to how vital lessons learnt from the development process could be codified and applied. Through the implementation of the Y2K programme, the organisation placed more emphasis on how lessons learnt from the IT development could be shared by other organisational members who would benefit from such knowledge.

It is clear from the above discussion that the implementation of the Y2K programme enhanced the experience of managing cross-functional projects on a global scale with a long project life span. More importantly, the findings of the case study suggest that an organisation can learn from what it does and applies the learnt lessons to its future actions. Hence, the essence of organisational memory reconfiguration does not merely lie in the accumulation of new knowledge. Equally importantly, as evident in the case study, reconfiguration of organisational memory serves as a vital mechanism to inspire generative learning [26].

IV. CONCLUSION

The industry "best practices" circulating broadly during the early- to mid-1990s emphasised the strong centralised technical approach as the only viable option. While the Y2K computer problem has presented a unique opportunity to reveal and test global computer-related dependencies [23], the problem also has some vital organisational

implications. One particular implication is the issue of knowledge integration. Instead of contributing yet another account of the technical processes of the Y2K problem, this analysis has concentrated on the mechanisms of knowledge integration underlying the GMP in the hope of understanding and preserving the valuable lessons learned from this unique computer challenge. Specifically, it illustrates why the implementation of the Y2K programme in NatWest GFM was not simply a technological issue but also posed a social and emotional agenda. The analysis highlights a number of lessons that can usefully be applied to other global IT projects.

In particular, three vital lessons are learnt from this study that can serve as guidelines for managers to ensure the future success of knowledge integration within a cross-functional, globally oriented project. First of all, a standard procedure for implementing projects should be initiated and agreed. This helps not only to improve communication efficiency, but also to monitor project performance across various business units, particularly for those dispersed around the globe. It is also beneficial in ensuring that knowledge is articulated and codified in the same way. This further reduces the complexity caused by different implementation approaches. Secondly, the quality and skill of people should be taken into account when forming the project team. It is vital to have members who possess both the necessary project management skills and also interpersonal skills. Furthermore, managers have to ensure that at least one or two team members have substantial seniority within the organisation, including both abundant experiences about the organisation and broad personal networks. The final lesson to be learnt is how organisations can constantly learn from what they did and apply what they learnt to their future actions. It is clear from the case study that a cross-functional project like the Y2K programme can generate numerous valuable lessons which can then be further applied by the company in its future actions. Clearly, such lessons are not limited to the accumulation of project management skills and knowledge but can equally well be considered as a foundation for reconfiguring existing organisational practices.

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