

AN INVESTIGATION OF THE USE OF METHODS WITHIN INFORMATION SYSTEMS DEVELOPMENT PROJECTS

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Abstract: The development of information systems has always been and remains a volatile environment. Practitioners and researchers within the field of information systems development (ISD) have put forward a number of different ideas over the past thirty years to better monitor and control the area. The ISD method has been one such idea that has not only achieved widespread application but has garnered many criticisms regarding its application. This study sought to investigate whether these criticisms are supported in terms of how present day organisations utilise ISD methods. The findings of the study indicate that whilst methods are considered an integral part of the majority of development projects, they cannot be adopted without a significant amount of restructuring to suit individual development projects.

Keywords: Information systems development, information systems methods

1 INTRODUCTION

The purpose of this study was to investigate the nature of information systems development (ISD) at the present time and in particular the nature of ISD method usage. Earlier studies have also addressed this area (Fitzgerald, 1997; Hardy et al., 1995; Sitek and Sumner, 1986). However, the ISD environment has changed significantly in recent years and a new study investigating the use of ISD methods is timely. In addition, this study looked at Irish organisations solely. There is a multitude of literature criticising the use of information systems development methods (Baskerville et al, 1992; Korac-Boisvert and Kouzmin, 1995; Larrasquet and Clare, 1996). An investigation of how ISD methods are applied in actual development projects to uncover whether practitioners have the same opinions of ISD methods was conducted. This investigation sought to answer how methods are employed within development projects and how practitioners perceive methods. The basis of the study was an earlier survey conducted into ISD method usage within Irish development projects (Kiely and Fitzgerald, 2002). In the next section, issues relating to ISD are briefly presented, such as the systems development life cycle and ISD methods. Following this, the research method chosen for this investigation is described and the findings of the

research study are presented and analysed in relation to each other. Conclusions are then presented for the research study.

2 THE INFORMATION SYSTEMS DEVELOPMENT ENVIRONMENT

The field of information systems is a relatively new one. The first commercial systems were developed in the 1950s (Friedman, 1989) and in the intervening years information systems have become integral to organisational operations. Gradually, computer systems became widespread within organisations and grew more sophisticated due to increased needs of users and advancing technology.

However ISD was not a stable process. The emphasis was on the programming aspect of development and there was no set practice for how systems should be built (Friedman, 1989). That a new information system was functional, cost-effective and accepted by the intended users was largely a “hit-and-miss” affair. As a result of this environment, the term ‘software crisis’ was coined in 1968 to describe the problems, which plagued the development of information systems.

The ‘software crisis’ is commonly taken to mean the high level of project failure; budget overruns and missed deadlines within ISD. These are standard problems, which have plagued development of information systems and continue to do so at present (Korac-Boisvert and Kouzmin, 1995). Information systems projects continue to fail at an alarming rate and the problem of ‘runaway’ development projects has never been more serious. For example, a recent study estimated that American companies spent \$59 billion in 1995 in cost overruns on runaway IS projects (Johnson, 1995).

Initially in the 1960s, IS was a new area and there were no standards in place to monitor development and evaluate end-results. Practitioners in the IS field became concerned with the nature of development and how the process might be controlled. An early solution was found within the academic areas of science and engineering (Baskerville et al., 1992; Quintas, 1996). The idea was to break up the development process into logical phases such as analysis and design to better manage the development process.

2.1 Information Systems Development Methods

Methods became part of the development process in the 1960s and 1970s as developers became aware that instances of IS development were escalating and some regulations or guidelines might be useful. Following on from the SDLC (Systems Development Life Cycle) (Royce, 1970; Avison and Fitzgerald, 1995), these early methods sought to further standardise the development process and bring greater stability to the area. SSADM (Structured Systems Analysis & Design Method), IE (Information Engineering) and YSM (Yourdon Systems Method) are typical of traditional methods.

Traditional methods are easily identifiable by their characteristics. Whilst each may differ in certain aspects, they are all coming from the same basic principle – the structured, scientific paradigm (Korac-Boisvert and Kouzmin, 1995). In addition, this approach has met with many criticisms since its creation (Bjorn-Anderson and Hedberg, 1977; Land, 1980; McFarlan, 1974). By trying to control all the variables associated with development, the hard methods tie developers in to a certain development path and it can be argued that this stifles creativity

(Baskerville et al., 1992). A relevant concern may be the argument that traditional methods prolong the development process, as all phases are carried out in sequential order.

The majority of methods adopted by organisations are derived from ideas from the 1960s-1970s. This is a fact supported by much of the literature concerned with ISD methods (Baskerville et al., 1992; Fitzgerald, 2000; Larrasquet and Clare, 1996). These methods were designed in a time when ISD was in its infancy and the very nature of these traditional methods reflects this point. Typical traditional methods take a rational, incremental approach to development with an emphasis on the ability to control each facet of development.

Large organizations still utilise these project management methods originally borrowed from the engineering and construction industries during the 1960s (Korac-Boisvert and Kouzmin, 1995). This is a strange occurrence when the extent of technological and social advances are taken into account from the past thirty years. Yet, in the area of ISD, techniques and methods from thirty years ago are still used frequently. This might be appropriate if the methods were effective and if the environment in which they are used had not changed but this is not the case. The environment has changed beyond recognition in the past 30-40 years (Korac-Boisvert and Kouzmin, 1995) and traditional methods cannot in any way be considered a perfect aid to development – in fact, the opposite is very much the case (Baskerville et al., 1992).

The origins of the concepts upon which methods are based can be found in the engineering and science fields. Literature regarding the area frequently cites other academic areas as the source for IS methods (Kouzmin and Korac-Boisvert, 1995). In particular, ideas were drawn primarily from engineering and science. The concept of “divide and conquer” – breaking the development down into manageable phases (Baskerville et al., 1992). However, these concepts do not necessarily fit the area of ISD.

Information systems development (ISD) is not solely a technical process. Any IS development incorporates a number of interrelated elements such as the technological, the business and the social. Zuboff (1991) states, “using the technology to its full potential means using human beings to their full potential”.

This argument that ISD is more than a technical problem is a point supported by literature (Baskerville et al., 1992; Brooks, 1987; Fitzgerald, 1996; Korac-Boisvert and Kouzmin, 1995; Vitalari and Dickson, 1983). However, although it is taken as fact that ISD is not just technical, this factor is not typically supported by traditional methods. Traditional methods for the most part, disregard the influence that the social aspects can have on development.

Discussion involving the flaws of traditional methods leads to the question of whether methods are relevant at all in the current age. Perhaps there should be no methods at all, that there should be no set method for development in organisations. This is an intriguing viewpoint but one that is probably not realistic at present in the area of ISD. People and organisations like to use methods, even if they are flawed because they project an air of stability and confidence in the IS area (which has picked up a reputation for being chaotic and unstable). This is an opinion supported by Wastell (1996) who states that “methods are elaborate devices used as a “social defence” for containing the acute and potentially overwhelming pressures of systems development”. Whether or not it is the case (and it has been fairly conclusively argued not to be), methods have been hailed as a cure-all to IS ills.

The real question to be considered is whether these traditional methods are relevant in their current incarnation. Judging from the many criticisms that are currently attached to traditional methods (Korac-Boisvert and Kouzmin, 1995; Larrasquet and Clare, 1996; Baskerville et al., 1992) their relevancy appears to be in doubt. Traditional methods have only limited application in the present age because software development is no longer a predictable and static process.

Development is now ad-hoc and emergent in nature. Therefore methods should accommodate the changing nature of development. In the majority of cases hard methods are not the ideal option and other alternatives should be considered. Korac-Boisvert and Kouzmin (1995) state that “all IT development projects are not amenable to a conventional methodology and conventional project management techniques”.

3 RESEARCH DESIGN AND METHODS

This study has two main research questions. Firstly, it sought to address how ISD methods are employed within development projects. The second research question looked at how practitioners perceived ISD methods.

The research study was conducted on the basis of an earlier quantitative study of Irish development projects (Kiely and Fitzgerald, 2002), which used the same research questions. Based on the survey findings from this study, a number of respondent organisations were selected for further investigation.

The research method for this study was the case study. Although criticised on a number of points by Dutton (1988), this approach is the most commonly used qualitative method for research in information systems (Orlikowski and Baroudi, 1991). Case studies are an effective approach for this study as the purpose was not to uncover a generalisable truth, but rather to explore and describe the development environment in three distinct settings.

This research study used three case studies. The organisations were selected on the basis of responses provided during the preliminary survey study. The first case study concerned a large multi-national corporation, Organisation A, which has operations in Ireland. The organisation was chosen as a case study both for its high levels of in-house systems development and the absence of a method within development projects.

The second organisation used for a case study was Organisation B. Organisation B is a small Irish-based web development company. Organisation B’s suitability as a case study lay in its usage of an in-house designed method and small development team, which is in direct contrast to Organisation A.

Organisation C was the third organisation selected for a case study. Organisation C is a large multi-national involved in the telecommunications industry with operations in Ireland. Organisation C was chosen because of the number of large scale, critical projects currently in development. In addition, Organisation C utilises a comprehensive in-house method for its ISD projects. Although Organisation B also used an in-house method, the organisations operate in different industries and differ greatly in size.

The data collection within the organisations occurred in 2001 using in-depth interviews with individuals who were involved in ISD. The researcher used a combination of ‘focused’ and ‘open-ended’ questions for the purpose of interviews, which were unstructured in nature (Yin, 1989). The focused questions allowed the researcher to acquire a ‘grounding’ early in the interviews, which was used as a basis upon which to ask open-ended questions. In addition, the open-ended questions allowed the researcher to gather richer information from the interviewees and allowed the interviewees in turn to discuss issues, which they felt were important to the area of research (Remenyi and Williams, 1995).

This research method is not without its drawbacks. Case studies provide very little rigour, take a long time and provide little basis for scientific generalisation. In addition, the softer a research

technique the harder it is to do. However, in this study the interest lay mainly in understanding and discovering the experiences of the individual projects, not in applying these findings to a larger sample (the earlier research study which surveyed over 100 Irish organisations had already investigated the area from this viewpoint – http://afis.ucc.ie/gkiely/survey_site).

4 RESULTS

4.1 Organisation A

Organisation A has grown to become a large multi-national organisation, mentioned on the Fortune 500 list and having operations in a number of countries around the world. The main purpose of Organisation A's Irish operations is the distribution of its products within Ireland and neighbouring countries. Organisation A also has an ISD department which develops SAP based systems that are rolled out to other European operations and the majority of development is carried out internally (90%). Currently, Organisation A employs nearly 100 personnel at its Irish operations.

4.1.1 Development at Organisation A

SAP is a type of software that caters for the integration of processes within and among enterprises and business communities with the intention of improving relationships. Organisation A underwent the first installation of SAP in 1997 and the software has been installed throughout the worldwide organisations since that point. Organisation A's Irish operations had its first SAP installation 1998. Organisation A has a number of SAP based developments in progress at present. The development project, which is the focus of this case study, is that of the budget and planning process, which is being converted to SAP. This SAP system will be rolled out to all of Organisation A's European operations.

4.1.2 Method Usage at Organisation A

Organisation A does not use a method (commercial or in-house) to aid the development of information systems projects. The reasons for this lack of a method are mainly focused around Organisation A's need to be flexible and unconstrained when it comes to selecting the best approach towards an individual development project

However, the fact that there is no prescribed method used with Organisation A ISD does not mean that the development is without structure. Every development within Organisation A is well planned before any actual work takes place and a significant amount of time is taken to ascertain users 'needs and wants'. All interested parties are invited to offer their opinion on the development and offer suggestions. In actuality the process is very well defined and is much to do with the experience of personnel in the department rather than popular opinions surrounding ISD. Organisation A has found very little disadvantage to this ad-hoc approach to date and it seems to work successfully. A development team member believes that 'it really depends on the people and the project leader. There is a highly selective approach in hiring personnel for the development centre'.

Organisation A also believes that it is difficult to create a method (commercial or in-house) that would fit every single development scenario within their organisation and that traditional methods take too long to develop systems, which is time and money that a company cannot afford to lose.

In addition, Organisation A believes that the greatest benefit of their approach to development is flexibility. Organisation A development team can do what is needed to get the project completed successfully without worrying about adhering to any particular ISD method.

4.2 Organisation B

Organisation B provides consultancy services, created and delivered websites and online marketing campaigns for SME and Blue Chip companies. Organisation B specialises in the development and promotion of websites and interactive multimedia.

In addition, Organisation B is the first company in Ireland to have designed, placed and managed marketing campaigns across UK and Irish online media. Organisation B serves clients all over the world, from Australia and China to Germany, the UK and Chile, in the design of corporate identity and company promotional brochures.

4.2.1 Development at Organisation B

Organisation B has a number of development projects in progress. Three projects are application development projects, one is an e-commerce project and another is an Internet site. The focus of this case study is Organisation B's e-commerce project. The project is a site for purchasing software online. The site will allow users to browse and buy software, which will be sent direct to their designated address. The project is of high priority to Organisation B, in that the organisation's continued success depends on the completion of the project.

4.2.2 Method Usage at Organisation B

Organisation B uses an in-house method that has evolved over the five years that the company has been in business. In addition, this in-house method is modified for each new project. However, these modifications are not too large. They are done mainly to accommodate the preferences of the client and secondly, to cater to the technology being employed in the project. Organisation B says 'you see sometimes you have to backtrack in development and also the type of project will vary. One method will not suit all projects'.

Organisation B's lead developer also stated that a method, which does not fit a development project, can also be a big headache for the development team. He also stated that in his previous experience working for a large development organisation, 'too often methods were enforced from higher levels in organisations without much thought given to what suited the development environment'.

In general, Organisation B was of the opinion that there were quite a lot of commercial methods that were outdated, took too long and should not be used with current developments. In general, however, the opinion was that the majority of methods had their particular applications and that it all comes down to the type of development to be conducted. For example, a small project with a small number of developers would not necessarily benefit from the application of a

method whilst a large-scale development with a significant development team would most likely benefit from a method being in operation.

4.3 Organisation C

Presently, Organisation C is a global leader in providing integrated communications solutions and embedded electronic solutions. Organisation C's presence in Ireland is located in Cork in the south of Ireland. Employing 500 plus engineers, the N.S.S operation involves the design, test and support of telecommunications networks for markets in over 30 countries.

4.3.1 Development at Organisation C

The project concerns the network management of digital cellular telephone networks, UMTS. UMTS is a Third Generation (3G) mobile technology that will deliver broadband information at speeds up to 2Mbit s/sec. The goal of UMTS is to enable networks that offer true global roaming and can support a wide range of voice, data and multimedia services. Besides voice and data, UMTS will deliver audio and video to wireless devices anywhere in the world through fixed, wireless and satellite systems.

4.3.2 Method Usage at Organisation C

The method utilised by Organisation C is in-house designed. It was designed taking the SDLC at the organisation into consideration. The in-house method covers areas of development, such as testing, project management and quality. In addition the Organisation C's method states these areas' roles within the development process.

There is an emphasis on control and structure within Organisation C's in-house method. This element is partly due to the industry and technology used by the organisation, which 'flourishes in a well structured development environment'. This focus on structure is also due to the criticality of many of the development projects that are conducted at Organisation C. Projects cannot afford to go over schedule or cost more than initially estimated.

The in-house method at Organisation C is applied and adhered to across the organisation. However, this method is not static and is tailored for specific project purposes. To aid this process, development personnel use pictorial representations, called 'PROMPT maps' (Fitzgerald and O'Kane, 1999) to illustrate the method used for the individual project and 'highlight deviations from the standard method'.

A development manager explained the reasons for modification of the method further, by stating that in the case of smaller, simpler projects, the overhead required to follow the complete method would be unwieldy and not always a necessity to project success. A second example of where methods were modified was 'to speed up the development process where phases of development overlapped'. This overlap is usually driven by tight project schedules.

The development manager also stated that although methods were by no means outdated for current development projects, they did think that in some cases methods (in general), needed to be adapted for the technology used within development. The development manager cited an example of methods, which are influenced by the structure of the Waterfall SDLC. They were of the opinion that such methods did not lend themselves to object oriented development, where 'it helps to interactively design and code (or prototype).

The development manager at Organisation C stated that the method utilised by the development team was ideal for development because it has the ability to be adapted or tailored to suit individual projects. In addition, it was felt that the project could not have been completed successfully without the presence of the method. The reason given for this belief was that 'it is a large scale project with a lot of people working on it and it is necessary to apply a methodology which is known, understood and adhered to by everybody concerned.

5 DISCUSSION

The organisations that have partaken in the case studies are both similar and different at the same time. Whilst both Organisation A and Organisation C are part of large multinationals, which receive much support and guidance from the US operations, Organisation B is a small Irish owned company trying to survive in a very competitive Internet development market. However, despite being different in structure and the markets in which they operate, all three organisations have common concerns within the area of method usage.

5.1 Information Systems Development Methods

Within the use of ISD methods, the organisations differ. Organisation A does not use a method whilst both Organisation B and Organisation C utilises an in-house designed method.

Organisation B's method evolved through the experience of personnel at Organisation B. It is a method made up of best practices that personnel learnt through the experience of over 1000 individual development projects. However, personnel at Organisation B are also of the opinion that one method cannot suit all the development projects that the organisation undertakes and therefore, the method is altered to suit the development scenario and client demands.

The need for speed was the main motivator at Organisation B for method usage as the market that the organisation operates within is very competitive, and the company relies on maintaining its reputation for quality and speed. With so many companies offering the same services, a company as small as Organisation B must keep within its budgets and deadlines at all costs. For this reason, the tools and techniques that accompany a method were rated by Organisation B as the greatest benefit.

Speed was also the reason that Organisation B would not consider using a commercial method, as they were not only outdated, did not suit the types of development Organisation B undertakes but also made the development of systems take too long.

Organisation B stated that the greatest drawback of using a method, was the danger of following the method rather than finishing the development project and thus taking up more time than necessary.

Organisation C utilised an in-house method for ISD projects. The method was designed to cater for the development life cycle, which was explicitly stated and used by development teams. In addition, the method is very comprehensive, covering all phases of the development process. It tries to enforce consistency and quality in development practices. The main motivation for method usage at Organisation C is control. Organisation C wants to ensure clarity and structure within development projects. This structure ensures that organisation critical development projects will stay on track, which is a major concern for the organisation.

In addition, the development project focused upon in the case study [Section 4.3], is a large scale, long-term project and therefore from a logistical viewpoint, overwhelming. Utilising a comprehensive method that all personnel are familiar with ensures that development does not become chaotic.

As with Organisation B, there is a significant amount of modification of method. This modification is dependent on the project type, but occurs with such frequency that Organisation C use formal documentation to illustrate the deviations from the method with specific projects. Organisation C credits their in-house method with many benefits. These benefits involve providing a framework for development, ensuring consistency in development practices and maintaining quality in development. These benefits indicate that Organisation C's major concern is with completing high quality projects in a timely fashion.

Organisation C did not state any drawbacks to method utilisation as they argued that both the development life cycle and the method itself were completely flexible and could be adapted to suit individual development scenarios.

As previously mentioned, Organisation A did not use a method for development. The reasons for non-usage were much the same as Organisation B's reasons for using an in-house method. Firstly, using a method would prevent the development team from using the best approach possible for development. Meaning that use of method decreases the flexibility within development. Secondly, Organisation A felt that using a method had no great bearing on the development's successful completion and that success was largely due to the experience of the development personnel. Thirdly, Organisation A agreed with the opinion of Organisation B personnel that no one method suited every development project and that to try and design one would result in a method too vague to be effective. Finally, Organisation A also agreed that commercial methods slowed up the development process and that it was time that a development team did not have time to waste.

However, Organisation A still had a structure in place for development of systems but tried to maintain enough flexibility to change to suit each situation. Organisation A's development approach is very much an emergent approach to development. The term 'emergent' refers to Organisation A's anticipation of changing elements in the development process. The nature of development is such that Organisation A is of the opinion that the development team cannot assign a particular method to suit a development project. Organisation A feels that it is impossible to predict the exact requirements for development because these requirements may change between the initiation of a project and completion of the development. For this reason, Organisation A prefers to have a simple structure in place to cater to IS development and can be built upon as the development requirements/logistics warrant.

All three organisations greatest concern appears to be anything to do with speed and the duration of projects and by connection anything that would effect the duration of systems development. This concern fits with Rockart & De Long's (1988) observation of the 'faster metabolism' of business.

In addition, both Organisation A and Organisation B mentioned the fact that some commercial methods are outdated and do not fit the type of development they are involved within at present. Organisation C, whilst stating that methods were not outdated, were of the opinion that in a number of cases, methods had to be adapted to suit the technology used in the project.

Both Organisation A and Organisation B also commented that the majority of commercial methods negatively affect the speed of development. These opinions of commercial and traditional methods fit with much of the literature in the area of ISD methods.

6 CONCLUSION

The nature of method usage, which was uncovered by the case studies, reflects a much more ad-hoc development environment. The variations on development projects have widened and method usage reflects this factor. The methods within the case studies were typically in-house and modified as the situation warranted changes. Method usage is much more a flexible, emergent process with development teams 'picking and mixing' elements from various methods to best suit the development scenario at hand.

The reasoning behind non-usage of commercial methods ranged from the economical to the theoretical. Practitioners felt that commercial methods were too expensive to use, and for this reason, an in-house designed method was more attractive as it cost virtually nothing. In addition, commercial methods were found to be too inflexible, 'set in stone' and prevented developers making quick turnarounds on the direction of a development if the situation warranted such an action.

Organisations also felt that a commercial method could not reflect or fit well into the organisational structure and that an in-house method could be specifically created to take organisational culture and structure into consideration. An in-house method also promoted a greater sense of ownership and therefore, acceptance within the development team.

In addition, in-house methods could be built using the past experience of personnel as they could incorporate what worked best within past development projects and discard the elements that caused problems or achieved little for the development process. Also, the method could be altered as personnel attained more experience within various developments.

The conclusions made on the basis of the three case studies are identical to the findings of the earlier survey study, which was conducted [http://afis.ucc.ie/gkiely/survey_site]. In both studies, there was widespread use of ISD methods. The methods were typically in-house designed and modified on an ad-hoc basis during development projects.

The real question is what this all means for the ISD environment and ISD methods. When ISD methods were first designed in the 1970s, they were an unknown quantity and thus, ascribed with capabilities that had yet to be proven true. However, in the past thirty years practitioners and researchers have had time to investigate the usefulness and effectiveness of ISD methods. Methods are not a cure-all for a development process but can aid the development process if applied properly by experienced personnel.

As such this is reflected in the way that methods are currently used within development. Practitioners are not cynical about methods as such, but have a better appreciation of a method's worth within the development process. For this reason, methods are no longer applied blindly to the development process in the optimistic hope that it will ensure a successful development process.

However, this is not to say that methods are no longer utilised. Methods are used in the majority of development projects. The change is in how the methods are applied within development, as the majority of methods are modified for development processes. The general opinion amongst practitioners is that whilst methods have their uses, they do not solve all of developments issues and methods do not suit every single development situation.

Further research in this area is required. In particular, this study has focused on ISD projects, which were in the middle of development. It would be useful to return the three organisations once the development projects have concluded to re-evaluate the use of the ISD methods or lack

thereof. In addition, investigating the applicability of new developments such as extreme programming in the three case studies could provide interesting findings for comparison.

The area of ISD appears to have achieved a realistic view of methods and their abilities. The focus is on solving the problem and using whatever suits the situation to develop a system more quickly with less cost. All of these findings support the idea of emergent information systems development methods.

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