

December 2002

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Critical Reflection in IS Research Methodology: considerations for research design selection and deployment

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Abstract

In information systems (IS) academic debates on the comparative merits of particular methodological approaches, reflection on the role of personal preference in initial methodology selection remains rare. More significantly, while most IS researchers identify limitations in their research approaches, rarely do they engage in detailed examination of the appropriateness of their research designs to their specific research contexts or acknowledge the constraints imposed by the phenomena being studied. This paper contributes to the on-going development of critical reflection in IS research design by exploring these issues as part of the development of a research approach to ISS (Information Systems Strategy) amongst Australian biotechnology firms.

Keywords

AI0102 Case study, GA0101 Strategic IS, IB01 IS Research Methodologies, IB03 IS Research Issues

INTRODUCTION

In the post-Kuhnian era, the conduct of research in any academic discipline should involve analysis of methodology and research aims, as well as self-reflection on the influence of the philosophical stance of the researcher on their selection. While there has been considerable debate in IS about the respective merits of methodological approaches along the rather artificial quantitative/qualitative divide, it is only recently that the need for such self-reflection has emerged (Olson, 1995). Indeed, it may be argued that the over-concentration on research methods has in some ways been detrimental to the core IS objectives (Moody and Buist, 1999) of improving the effective planning, design, implementation and use of information systems in practice (Keen, 1991; Webber, 1997).

While recognising the need for more analysis of the role of personal preference in the selection of methodological approaches, this paper identifies a number of other research design issues that also require more detailed consideration. Drawing on the experience of developing a research approach to information systems strategy (ISS) amongst small to medium sized enterprises (SMEs) in the Australian biotechnology industry, this paper explores the possibility of applying the principles of critical reflection to the initial stages of research design. As Travis (1999) has noted, each research paradigm contains different methods that are useful in different settings and for different purposes that should be compatible with the goals of the research and the researcher. The paper presents a list of factors that may influence a researcher's choice of method and the effectiveness of the techniques utilised. Critical reflection is suggested in these circumstances as an approach for identifying and defining these factors and analysing explicitly how these factors will influence the research method choice and impact the effectiveness of the deployment of particular research techniques.

In developing a research design it is evident that the research aims are the key driver in determining the selection of a researcher's over-riding research methodology (Trauth, 2001b). However, it is readily acknowledged that personal preference, disciplinary or institutional style also impact on the methodology choice. This paper highlights that while methodology selections vary, the role of the research context and the phenomena being

studied need to be reflected on. This is because of their potential significance in impacting on the effectiveness and/or deployment of particular research techniques with any given methodological framework. Rather than comparing particular methodological frameworks, it is the importance of context and phenomena sensitivity with respect to the selection and deployment of particular research techniques within any given methodological framework that is the focus of this paper.

BACKGROUND AND MOTIVATION

Within a young discipline like information systems the practice of borrowing and importing research approaches from other disciplines is common (Garcia and Quek, 1997). While this practice has been successful in introducing diverse approaches, it has also led to vigorous debate on the comparative merits of particular research methodologies. Unfortunately, often these debates have become polarised along the artificial divide between positivist versus interpretivist approaches and qualitative versus quantitative methods (Moody and Buist, 1999). Although advocacy for particular research methodologies and techniques is an important component of any research discussion, there is a danger that it may introduce bias as researchers personal preferences or institutional traditions cloud judgement in the selection of the most appropriate research tools for the aims and objectives of a given research project in a particular research context (Klein *et al.*, 1991).

In this research paper these considerations are explored as part of the development of a research approach for investigating information systems strategy (ISS) in the Australian biotechnology industry. The impetus for the paper came from the researchers experience in developing a research design that was both appropriate to the research aims and to the context in which the research was to be conducted. A preliminary analysis of the research context revealed that the behaviour of these biotechnology firms that are examples of knowledge-based small to medium sized enterprises (SMEs), did not reflect that of normal SMEs (Clarke and Turner, 2001). Further investigation suggested that the uniqueness of the context and the phenomena would raise questions about appropriateness of applying conventional research methods and techniques. This paper is based on lessons learnt from developing a research design for the biotechnology industry. This process has been generalised to enable other researchers to learn from the experience and to highlight the utility of critical reflection in the research design stage of a research project. The principles underlying the process of critical reflection are explored in this new capacity of being utilised in the research design stage. The paper illustrates how the nature and context of a given research topic, in this instance the Australian Biotechnology sector, imposes numerous limitations that impact on the effectiveness and validity of different research techniques. Consideration of these limitations is shown to be vital in making an appropriate selection and deployment of specific research techniques. This paper builds on this point and argues for researchers to be more explicit about how their research approaches 'fit' or are effected by their research fields. As Mumford has put it 'we must always think of the research situation and what is most appropriate there' (Mumford, 1991:26)

OVERVIEW OF CRITICAL REFLECTION

Sandercock (2000) has defined critical reflection as thinking seriously or critically about something, and as concentrating one's thoughts upon an idea, issue, dilemma or topic. For Copeland *et al.* (1993), the process of critical reflection goes beyond merely thinking and also involves problem solving that attempts to make sense of a challenging situation. This problem solving identifies areas of practice needing scrutiny and defines goals for the improvement and pursuit of actions (Copeland *et al.*, 1993). While for a number of other researchers critical reflection is a process of questioning the validity of assumptions and beliefs that shape practice (Mezirow, 1991; Cranton, 1996; Marsick and O'Neil, 1999). In this paper, a combination of these perspectives is deployed to critically reflect on the issue of 'research design'.

Conventionally there are four phases to critical reflection: identifying; analysing; connecting; and applying (Sandercock, 2000). In deploying these four phases to reflect on the research design process, this paper suggests critical reflection should involve: *identifying* the issues that may influence the research design; *analysing* the role and impact these issues may

have on the research design; *connecting* these issues with research design and *applying* the result of this reflection process to the research design focusing on the selection and deployment of research tools and techniques.

Critical reflection has tended to be utilised in such approaches as action research, ethnography and critical theory as a form of post-mortem examination of the research. This process of critical reflection seeks improvements and contributes to maintaining rigour in subjective research (Fielden, 1998). Following Peters (1997:71) the importance of critical self-reflection in the action research process is to highlight 'the need for any researcher to examine his or her assumptions about any aspect of his or her research'. While these reflective practices are considered beneficial in any research they emerge as critical in some research (Cecez-Kecmanovic, 2001). Undertaking critical reflection means that researchers are less likely to dismiss the outcomes that do not fit with previous notions (Fielden, 1998). This paper suggests that the heightened level of awareness and sensitivity that results from critical reflection in post-mortem examination is also very relevant to the research design stage. In this stage it is equally important that researchers consider and reflect on the impact the research context and research phenomena may have on how they operationalise their research approach including the types of research techniques they select and how they deploy them.

Although, critical reflection traditionally has only been adopted in post-action stages of research, Schon's (1987) four categories of reflection suggest this process can be applied in earlier stages. These four types of reflection are:

- Reflection-on-action: reflection on practice, actions and thoughts undertaken after the research is completed;
- Reflection-in-action: reflection on phenomena and our instinctive ways of thinking and acting in the midst of action;
- Reflection-for-action: participation in the reflective processes that serve as a guide for taking future actions;
- Reflection-about-action: reviewing broader personal, social, economic and political contexts in which the action (the research) occurs.

This paper utilises reflection-for-action as its key focus and reflection-about-action to review, analyse and define the research context. The other two types of reflection (on action and in action) are not examined here because of their retrospective natures and because they assume that the research in question is either in process or has been completed.

REFLECTIONS ON RESEARCH METHODOLOGY: EXPLORING THE FACTORS

It is widely acknowledged by IS researchers that in addition to ones specific research aims, a number of other factors may influence the choice of research methodology including the object of study, theoretical and philosophical assumptions, the research context, and researcher preferences. (Trauth, 2001b). Unfortunately to date, there has been limited discussion of firstly, why it is important to know what these other factors are? Secondly, how researchers should examine these factors? And, thirdly, what researchers should do with their insights once they have identified and analysed them? At the broadest level, for a researcher to know what factors have influenced their choice of methodology stems from the need to be transparent about their research aims and objectives and the influence of personal or institutional factors in shaping their approaches. Discussion of the other two questions will be examined in more detail below.

Making the processes the researcher deploys in choosing and developing their research design explicit assists in demonstrating rigour by crucially linking aims and objectives to methods and techniques. Based on Schon's (1987) 'reflection for action' this forces researchers to identify and analyse components of their research situation, to elicit the connections between these various components and to ensure that these issues align with their research methodology and the techniques they intend deploying. At this broad level, this approach is independent of the type of research being undertaken. In other words this

critical reflection is applicable regardless of whether positivist or interpretivist, qualitative or quantitative research is being considered.

By deploying critical reflection, the following discussion addresses the three questions posed above and illustrates its utility in the context of developing a research design for exploring ISS amongst knowledge-based SMEs in the Australian biotechnology industry. The biotechnology industry is an exemplar of a knowledge-based industry (Finkel, 1999) with its main functions being research and development and its primary asset being its intellectual property (IP). In Australia, the industry is small by international standards, consisting of a number of large companies, including subsidiaries of multinational corporations and approximately 190 small companies (Ernst and Young, 1999). At the initial stages of research design, a literature review revealed current ISS research among knowledge-based SMEs (KSMEs) was underdeveloped. Initially, ISS frameworks developed for large organisations were applied to the SME context, although it was soon recognised that KSMEs possess characteristics that made some of these approaches inappropriate. More recently, this research has turned to developing ISS frameworks specifically for KSMEs. Although, these current ISS frameworks may be appropriate for some KSMEs, these models appeared somewhat inadequate when applied in the biotechnology industry context. This is because biotechnology firms possess some characteristics that make them more like large firms and that they appear to use their IP in innovative ways (Clarke and Turner, 2001).

Research Design Selection

Reflection on the Research Questions and Aims

Many researchers (particularly qualitative researchers) argue that the research problem is the most significant influence on the choice of a research methodology (Trauth, 2001b). An exemplar of this perspective is the view that 'the choice of research practice depends upon the questions that are asked, and the questions asked depend on the context' (Nelson *et al.*, 1992 in Garcia and Quek, 1997). According to Moody and Buist (1999), all research methods may be appropriate in different situations depending on the research question being addressed. Combining these perspectives highlights that it is therefore important for researchers to be clear on their research questions and aims before the actual choice of method is made. In essence, any choice of methods should be driven by and attuned to the research problem (Trauth and O'Connor, 1991). For example, it is suggested that case studies are most appropriate when 'how' and 'why' research questions are being posed (Yin, 1994) and/ or, if the research aim is to develop theory (Benbasat *et al.*, 1987). In contrast, when testing theory quantitative methods are most frequently selected (Gable, 1994).

In the case being explored here, the primary research question that developed was 'how do Australian biotechnology firms use their ISS to source competitive advantage?' From a theoretical perspective, the aim was to explore how ISS is utilised in a knowledge-based SME context particularly in the management and exploitation of the intellectual property and intellectual capital. Given that the research question and research aims are exploratory in nature a case study method was suggested as appropriate. Case study research being suitable to research where little is known about the phenomenon (Eisenhardt, 1989).

Reflection on the Object being Studied

In IS as with many other fields, the origins of methodological debate can be found in the difficulties researchers often have in defining the actual object of information systems research (Kuuti, 1996; Garcia and Quek, 1997; Dobson, 2002) The most obvious question being 'Is the object of research in information systems of a technological or social nature?' (Dobson, 2002). Of course, even this assumption separating technological and social factors needs to be questioned (Wynn, 2001). However, both views reinforce the point that identifying explicitly the nature and characteristics of the objects to be studied should be prior to the selection of the methodology (Dobson, 2002).

In the case being explored here, the object of this study was the identification of ISS amongst KSMEs. The context in which this research question is being asked suggests that it is may be exploring more socio- rather than technical factors. However, technology underpins the very essence of biotechnology industry innovation and the use of information technology in this environment must also be considered in this context. This echoes Wynn's

(2001) comment above that it maybe inappropriate to separate the two sets of factors, particularly in an exploratory study. Again, the situation pointed to a case study approach as being well suited to exploring the object of study, especially as understanding the interactions between information technology-related innovations and organisational contexts began to emerge as a central focus (Darke *et al.*, 1998).

Reflection on Theoretical and Philosophical Assumptions

For some researchers, the identification and questioning of research assumptions is the primary strength of critical reflection (Brookfield, 1987; Cranton, 1996). From this perspective there are two broad categories of assumptions that a researcher should consider analysing via critical reflection:

- Philosophical assumptions are the researcher's view of the world and how knowledge is obtained and may be referred to as theoretical lens (Trauth, 2001b).
- Theoretical assumptions are assumptions that underlie IS and other related theory that could potentially influence how the research is conducted or certain objects perceived.

Brookfield (1987) and Cranton (1996) have both developed approaches for articulating, sourcing and challenging these assumptions that may be applied in this situation. In essence, any methodology relates and actually depends upon theoretical issues that are in turn bound to philosophical conceptions. It is the close connection between the three that guides research options (Garcia and Quek, 1997).

In the last decade, there have been numerous calls for researchers to reflect on their philosophical assumptions and explicitly define their stances when writing up their work (Walsham, 1995). In reflecting on philosophical assumptions, Nissen *et al.* (1991) point out that the discussion should be centred around two basic issues: ontology and epistemology (Garcia and Quek, 1997). A given epistemology may employ a variety of methods and similarly a particular method may be employed under different epistemologies (Trauth, 2001c). Therefore it is critical for researchers to be sensitive to their philosophical assumptions and acknowledge the important interaction between epistemology and methodological choice (Trauth, 2001c). For both Walsham (1995) and Garcia and Quek (1997) this process of reflection and articulation leads to a more coherent (i.e. consistent, rational, and logical) research process.

More critically for IS researchers there is a need to be aware of the underlying theoretical assumptions implied by the use of particular theories within the IS field. The relative immaturity of the IS discipline has resulted in a number of theoretical approaches and methods from other subjects being adopted, often with little regard for the associated 'baggage' of underlying assumptions (Garcia and Quek, 1997). Therefore to avoid a researcher blindly adopting these assumptions, an analysis of theoretical assumptions relating to their field of research is beneficial.

In the case being explored here, the exploratory nature of the research question and the focus on interactions of social and technical factors suggests the need to engage in some interpretation of participants' views and opinions regarding their actions in context. In IS interpretivist philosophies and aligned interpretivist research methods are already widely acknowledged as the most suitable research approaches for issues relating to organisational behaviour (Walsham, 1995; Myers, 1997). This suggests that an interpretivist case study may be the most suitable for this research.

Some theoretical assumptions underlying current ISS models also emerged from the literature review. Firstly, ISS models have been developed predominantly from a resource-based view (RBV) (Clarke and Turner, 2001). Secondly, this predisposition towards the RBV has led to ISS analysis being restricted to the organisational level (Clarke and Turner, 2001). Finally the nature of biotechnology KSMes suggests they are different from regular SMEs on which much of the ISS literature for SMEs is based (Clarke and Turner, 2001). Previous work in this area had been constrained by this organisational focus and to some extent explains some of the inadequacies of applying these models to the KSMes in the biotechnology industry. At a broader level, the issue of context appears to be an underlying

problem in the IS discipline in general. There has been a tendency to emphasise organisational level analysis (Walsham, 2000; Trauth, 2001a). However, the constraining influence of organisational level analysis in IS is now being challenged by new trends in the global knowledge economy thus reiterating the need for an expanded IS research scope. How the research design will address these assumptions is discussed below in the section on 'operationalising the research design'.

Reflection on Researcher Preferences

Another factor that is often influential on research methodology selection are researcher preferences. These are derived from personal, institutional and disciplinary spheres. Personal preference often comes down to the individual's prior skills, knowledge and experience with a particular set of research techniques (Trauth, 2001b). Similarly institutional and/or disciplinary traditional can exert pressure on researchers to work within a particular methodological framework or deploy particular research techniques by setting parameters around what is considered appropriate or valid research practice (Klein *et al.*, 1991; Orlikowski and Baroudi, 1991). Trauth (2001b) encapsulates these issues under the heading of academic politics and identifies factors including the country in which one works, one's status in the profession and the particular academic inclinations of the university as all influencing the choice of research methodology. By remaining critically aware of the potential of these factors to influence methodology choice, researchers are empowered to be more rigorous about the underlying pre-suppositions that may impact on their research approaches.

In the case being explored here, the personal experience of the researcher has been in scientific methods including a good grounding in quantitative research techniques. However, the researcher has also had training and experience in using qualitative research methods in the IS research context. The researchers current institutional environment has a tradition of adopting qualitative research techniques, although more recently this has begun to change. Nationally, there appears to be strong tendency for positivist IS research in Australia (Pervan and Cecez-Kemanovic, 2001), although it is acknowledged that some interpretivist research is emerging. In this research design, the researchers reflections support the perspective that the research aims and questions have been the main factors behind the methodology choice. From the defined research situation above, the most appropriate research method appeared to be interpretative case studies. The research aims to gain an in-depth knowledge of IP and biotechnology, the views of stakeholders on the use and management of IP and IS and insights into the contexts in which these activities are taking place. This type of data can be collected through empirical studies broadly classified as "interpretative case studies" (Walsham and Sahay, 1999). However, as Walsham and Sahay (1999) note that there are significant differences in methodology, theory, and technique covered under the broad heading of interpretative case studies. The selection of appropriate techniques that fall under this particular methodology will be discussed in the next section.

Operationalising the Research Design: Techniques Deployment

The second level in which critical reflection may be beneficial is the process of planning how the research will be conducted. This is specifically looking at what tools, techniques and instruments will be used to collect and analyse the data and how they will be deployed within the context of the specific methodological framework chosen (in this instance, interpretivist case studies). Critical reflection at this stage becomes an important process for reviewing how these techniques will be deployed to ensure that the research aims are met and are appropriate in the research context. An initial critique of previous research methods evaluating their relative success in meeting their research aims may provide some insight into techniques that have been useful or problematic. Secondly, the researcher at this stage should reflect on the chosen research approach and its limitations. Each research methodology and associated set of research techniques has their own limitations (Markus, 1997). Therefore it is important for researchers to demonstrate their awareness of these limitations and reflect on how these limitations will be addressed before proceeding to the data gathering and analysis stage. Finally, a reflection on research context may also provide insight into what techniques may be appropriate. These dimensions of operationalising research will now be discussed in more detail below.

Reflection on Research Context

To date in IS research, there is little evidence of reflection by researchers on the possible impact or limitations their research context could impose on the choice of research techniques. Trauth (2001b: 6) acknowledges the interplay between methodological choice and the context broadly encapsulated under the heading 'degree of uncertainty surrounding a phenomena'. Trauth (2001b) suggests that uncertainty about a phenomenon may affect the choice of research methodology. In this paper, the authors argue further that research context also has an affect on the selection, design and deployment of research techniques and on their effectiveness in collecting and analysing the data required to address the research questions.

Returning to Schon's framework above, the issues here revolve around 'reflection-about-action'. This type of reflection in relation to research context involves a review of the broader personal, social and economic and political contexts in which the action (the research) occurs (Schon, 1987). This process sensitises the researcher to limitations of their research environment and enables them to address these before heading into the data collection and analysis phase.

In some instances, the research context may influence the research design choice or impose limitations that may result in some research designs being inappropriate or difficult to carry out. Barrow and Thompson (1997) suggest that IS research cannot be conducted without considerations of the internal and external influences on the research. They suggest that the factors of time, budget and resources need to be evaluated (Barrow and Thompson, 1997). In addition, the environment in which the research is to be conducted must also be considered (Barrow and Thompson, 1997). The reflection on the environmental context of the research plays a significant role in the choice of research techniques for the Australian biotechnology industry. Ultimately the purpose of critical reflection on the operationalisation stage is to ensure that the techniques chosen and how they are employed are effective in relation to the research aims and questions.

In the case being explored here, the scoping stages of the research included reviewing industry reports and informal discussions with industry representatives. From these it became apparent that there would be a number of limitations in conducting research within the biotechnology industry sector. These limitations included definitional, methodological, confidentiality and data issues. A few of these limitations will be drawn upon to illustrate how a research context may influence how particular techniques are designed and deployed. Although interpretative case studies were deemed suitable as the methodological framework, the research context influenced the type and deployment of techniques that were to be used within that framework.

For example, secondary data analysis of the Australian biotechnology industry is problematic because of the lack of empirical data on this industry. The Australian Bureau of Statistics (ABS) statistical data gathered on the Australian biotechnology industry has tended to be encapsulated under the broader headings of research and development, innovation or science and technology. Secondly, there tends to be a lot of data reuse amongst different industry reports both at the national and state levels, for example figures from the Ernst and Young's (1999) industry overview report have been quoted in several state biotechnology reports. In a similar fashion, what is considered as 'biotechnology' is inconsistent between Australian States, and the term has in some cases been broadened to inflate the number of firms located in a particular region. Snow and Thomas (1994) have noted that there are concerns about researchers analysing firm strategy only through the deployment of statistical and secondary data sets because of the potential to overlook significant differences in firm approach. For example, DeCarolis and Deeds (1999) use patents and citation analysis as a representation of stocks of organisational knowledge, but as a consequence overlook the fact that some firms choose not to patent because of fear of disclosure, while other firms delay publishing because of fear compromising patent applications. Therefore secondary analysis may be problematic at this stage due to the lack of empirical data.

Another consideration in conducting interviews or surveys is finding sample populations or appropriate field sites. This is certainly a challenging problem in the Australian biotechnology

environment. There is currently no central repository of Australian biotechnology firms. AusBiotech, an industry association, collated a directory back in 1999 in which it was entirely voluntarily for firms to subscribe to and as a consequence the list is not reliable as a comprehensive director. Similarly only 35 out of 190 biotechnology firms are listed on the stock exchange, making the collation of background information difficult. Compiling a comprehensive list of biotechnology firms requires considerable cross-referencing between industry and government reports and websites to ensure a representative sample is identified.

Additionally, because the biotechnology industry in Australia is so relatively small, many firms fear that they will be identifiable in research even where they are made anonymous. As a consequence these firms may have issues with the type of information sought and how it will be used. This is accentuated further by the nature of the research topic as the area of strategy and IP tends to be commercially sensitive and the topic of biotechnology itself tends to be quite controversial both ethically and morally. Consequently firms may be reluctant to participate in the study. Therefore the availability of case study field sites (Darke *et al.*, 1998) or survey participants may be restricted. In response to this issue, this research design is focused on providing a practical output of value to the participating firms (i.e. a list of best practices for ISS in Australian biotechnology industry). Secondly, it is important to reassure the participants of confidentiality and anonymity. To some extent this can be achieved through an anonymous survey and presenting the results in aggregated form. In the case of interviews, it is essential for the researcher to establish rapport and trust with the participants. Finally, the sensitive nature of the topic and the size of the industry implies that the design of survey or interview questions requires considerable attention to ensure participation. A survey that poses sensitive questions directly to its participants is likely to compromise the response rate or the number of valid returned surveys. For example, asking a firm directly what their net profit is may not get a response in a survey but providing them with ranges may be more appropriate for obtaining this information. Similarly, in an interview situation it may be appropriate for a semi-structured interview approach, where the interviewer may be able to probe for the information they require, without directly asking the question outright.

This section of the paper, has highlighted that even when the methodological framework appropriate to the research has been identified, critical reflection can assist the research in calibrating their research techniques to maximise the effective of their data collection.

DISCUSSION AND CONCLUSION

Information Systems has already experienced substantial debate on the relative merits of different research methodologies. The key driver behind research selection should be a researcher's aims and questions. It is important for researchers to be explicit about how they arrive at their research methodology choice and how they remain sensitive to their research contexts in the selection and deployment of research techniques within that methodology. By examining these issues in relation to designing and developing a research approach for exploring ISS in Australian biotechnology firms this paper has highlighted the merits of critical reflection for ensuring sensitivity towards this issues and influences. Although the notion of researchers being explicit about how they derived at their chosen research method is not new, what is novel is applying the principles of critical reflection in a pre-analysis as an approach to achieving this.

This paper has demonstrated that research design needs considered construction (Travis, 1999). IS literature has particularly reflected on the importance in ensuring that the choice of methodology is consistent with research aims and the researcher's philosophical assumptions (Garcia and Quek, 1997). However, rarely do researchers engage in detailed examination of the appropriateness of their research designs to their specific research contexts or acknowledge the constraints imposed by the phenomena being studied. Instead, the importance and the impact the research context can have on the choice and effectiveness of the research approach tends to be implied through their research questions. Researchers should be explicit about their approach, which generally involves clarifying their research aims, theories and methods (Avison *et al.*, 1999).

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