CHARACTERISING INFORMATION SYSTEMS IN AUSTRALIA:

A THEORETICAL FRAMEWORK

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ABSTRACT

The study reported in this volume aims to investigate the state of the Information Systems academic discipline in Australia from a historical and current perspective, collecting evidence across a range of dimensions. To maximise the strategic potential of the study, the results need to be capable of integration, so that the relationships within and across the dimensions and geographical units are understood. A meaningful theoretical framework will help relate the results of the different dimensions of the study to characterise the discipline in the region, and assist in empowering the Australian IS research community. This paper reviewed literature on the development of disciplines, before deriving a theoretical framework for the broader study reported in this volume. The framework considered the current and past state of IS in Australian universities from the perspective of the development of a discipline. The components of the framework were derived and validated through a thematic analysis of both the IS and non-IS literature. This paper also presents brief vignettes of the development of two other related disciplines. The framework developed in this paper, which has been partly guided by Whitley's Theory of Scientific Change, has been used to analyse data collated from the Australian states and the Australian Capital Territory. The degree of variation in Australian IS as an indication of its "professionalisation", the nature of its body of knowledge and its mechanisms of control, will be used to frame the analysis. Research reported in several of the papers that follow in this volume has drawn upon the theoretical framework presented below.

INTRODUCTION

Information Systems (IS) is a relatively new discipline in the Australian context, as is discussed in Clarke (2006) elsewhere in this volume. Its contribution to Australia has increased with the growing understanding of the importance of computer systems in assisting organisations and individuals to achieve their goals. Given the growing contribution of the IS academic discipline to

Australia, the study reported in this volume is timely, as it aims to investigate the state of IS in the universities of the region. The strategic benefits of gathering data in order to access increased power, status and resources for the IS discipline in Australia in the future are obvious. However, to maximise the future strategic benefits of doing so, particularly as this Australian study is a pilot for future Association for Information Systems (AIS) studies in the Asian-Pacific region, the investigation needs to consider common questions in common ways. This paper develops a theoretical framework to provide a common way of looking at data collected over a range of dimensions from different geographical areas in Australia.

It is tempting to view the development of Information Systems (IS) in Australian universities as a unique case. However, there is a body of knowledge that attempts to explain changes in fields of knowledge, including the emergence of new disciplines. An understanding of the past development of IS will help those in the discipline to better position the future of IS in Australia. Much of the literature on the development of disciplines comes from the sociology and philosophy of science and dates from between the 1950s to the early 1980s. Since that period the philosophy of technology has emerged as another branch of philosophy, which includes study of the role of technology within the development of society (Gorokhov 1998). Some literature from both sources is relevant to a consideration of IS, as it is possible that many characteristics of its development arose because it was a new discipline, with involvement in technology. Therefore, the features and milestones of the development of IS may be typical of the early development of all or many disciplines and were not unique. This reasoning was supported in the IS literature by Farhoomand (1992) who contended that the nature of progress in a discipline needed to be examined within a framework of the philosophy of science. The concept accords with Popper's (1959) argument that discovery needs to be directed by theory, instead of theory being derived from empirical observation. The development of IS as a discipline has been considered in several waves (Fitzgerald 2003) since its first emergence, most recently by European and other researchers in 2002 and 2003. This work has examined both the origins and future of IS. Bauman (1992), however, believed that "only a *[flawed]* discipline …feels the need to justify its… exist*[ence]*" (p. 76). However, neither position has been influential in Australia, where there has been little examination of the nature and development of IS.

At least two different views could be taken on the state of IS, an external view from outside the academic field, and an internal one, as seen by IS academics (Hirschheim & Klein 2003). This paper, like much of the literature, largely focuses on the internal view of IS, leaving the external view to another time after an initial examination of the IS discipline in Australian universities has been undertaken. When taking an internal perspective, both research and teaching perspectives could be considered in a discussion of the state of IS in Australian universities. Most of the literature on the state and development of IS concentrates on research issues, rather than teaching. Consequently, the review of the literature presented below regarding the state and development of IS, places emphasis on research issues rather than on teaching issues.

Many view IS as an applied science, as evidenced by the accreditation of IS programs in US business schools by ABET (formerly referred to as the Accreditation Board for Engineering and Technology) (Challa, Kasper & Redmont 2005). Science has been described as a convention, where the norms, expectations and values of the group while searching for understanding are relevant (Klein, Hirschheim & Nissen 1991). As such, social characteristics are important to the development of science. Bunge differentiated between culture-free pure science and scientific technology, where the latter was applied in nature and involved ethics (1979), while later writers saw science and technology as being interdependent or hybridised (Pitt 2000; Latour 2003). There has been much debate about how scientific progress comes about (Lee 1989) with many

explanations having been put forward. The methods proposed for scientific progress include, for example, incremental verifications (the logical positivists), the increasing consensus of researchers (Polanyi 1958), the use of falsifications (Popper 1959), revolutions that overturn previous paradigms (Kuhn 1970), progressive or degenerative research programmes conducted over extended periods (Lakatos 1970), political practices (Foucault 1977) or through research trails versus tinkering (Chubin & Connolly 1982).

An overview of some of the literature related to scientific progress and the development of disciplines is presented in this paper, particularly where it has been linked in the past to IS. It is believed that the literature provides a theoretical context for a study designed to characterise the state of the IS academic discipline in Australia. After an examination of the literature, a framework will be developed to guide the collection and analysis of data for the study reported elsewhere in this volume.

IS AS A DISCIPLINE OR FIELD

There are different ways of defining a group of researchers undertaking related research. At least five definitions have been applied to IS. Keen (1991) saw nothing unique in IS research in its topics, theory or methodology, and referred to IS as a "self-defined community" as researchers "declare[d] themselves as members". King (1993) viewed IS as "not even a field", but as "an intellectual convocation that arose from the confluence of interests among individuals from many fields". A "field" has been defined as,

> ... an area of knowledge and learning which is not yet accepted as a discipline. Fields of study tend to be more recent areas of scholarship with somewhat fuzzy boundaries; significant numbers of concepts within them are open to debate; and researchers and scholars in the area tend to draw heavily on old-established disciplines for their methodologies and conceptualisations (Tardif 1989).

A discipline has sharper boundaries. Tardif (1989) saw a discipline as,

> ... a body of knowledge, definitions, and concepts built up over a long period and receiving consensus recognition by scholars; theories which interrelate the concepts and provide explanations of observed phenomena and permit predictions from them; and well established research methodologies.

Keen (1991 and King (1993) both saw IS as a sub-field. Hirschheim, Klein and Lyytinen (1996) referred to IS as a field. Even more recently, little consensus has been reached on whether IS is a discipline or some other grouping. In 2002, Paul viewed IS as a "subject seeking a body of knowledge" (p. 175). In the following year Fitzgerald (2003) saw IS as not "even close to being a discipline" (p.225), but as a perspective placed between technology and some other subject areas such as management.

A review of the literature suggests that researchers are still unsure about how to label IS. Many IS researchers have used the terms field or discipline interchangeably, avoiding the issue. Whether to label IS as a discipline, a field or as something else is likely to become clearer with greater awareness and understanding of its nature and development. Consequently, no attempt will be made in this paper to label IS in the Australian context as a discipline or otherwise. It is more appropriate to leave this analysis until after review has been undertaken of the study findings.

APPROACHES TO THE DEVELOPMENT OF DISCIPLINES

A number of different approaches have been taken to account for the nature of different disciplines and their development. A review of the literature identified that three of the approaches were largely considered independently of other approaches. These were *theory*, *social processes* and *research methods and standards*. However, more holistic approaches have also been used to explain disciplinary nature and progress, by considering two or more of *theory*, *social processes*, *research methods and standards*, *topics of knowledge*, *symbols sets for communication*, *the impact of local factors* and the *degree of professionalism*. Literature that deals with *theory*, *social processes* and *research methods and standards* to explain the nature and development of disciplines will each be examined in turn below, followed by literature that takes a more combined approach.

Largely Independent Approaches to Explain Disciplinary Development

Interestingly, some of the approaches to explain disciplinary development have waxed and waned in popularity at particular times over the last fifty years. In 1959 Popper argued that it was only through the generation of theories that scientific progress could occur. The importance of theory to a discipline has been recognised up to the present time.

Theory

Kuhn used the word "paradigm" in different ways including "universally recognised scientific achievements that for a time provide model problems and solutions to a community of practitioners" (1970, p.182). He argued that scientific progress arose as a result of new observation or experience that necessitated a "reconstruction of prior theory" and resulted in a paradigm shift. "Normal science" represented the body of theory, practice, and methods of enquiry that were accepted by a group of researchers, typically expounded in textbooks of the discipline. Wernick and Hall (2004) analysed the textbooks of a discipline allied to IS, Software Engineering, to examine the underlying belief system of authors from that discipline, to find that it was pre-paradigmatic with a common core of knowledge supplemented by competing sets of beliefs. It has been claimed by many researchers that there is limited theory in IS (for example, Grant 1991; Keen 1991; Paul 2002), while few textbooks have been published that provide an overview of the discipline. However, Hirschheim and Klein (2003) saw a "generalisation deficit" (p. 257) in IS, rather than a lack of "theoretical knowledge" (p. 268). Kuhn saw the presence of paradigms as a sign of maturity in a discipline, as they gave researchers a basis for choosing problems as well as guiding them in their investigation. Despite frequent discussion of Kuhn's work in articles about its development, IS has also been classified as pre-paradigmatic (Culnan 1987; Seddon 1991). Consequently, from this perspective it appears that IS may not have achieved the state of normal science, at least not by 1991.

Kuhn's (1970) analysis of physical optics before the time of Newton is illuminative. As that discipline had "no common body of belief ... each writer ... [built] his field anew from its foundations ... [and] ... there was no standard set of methods or of phenomena". Kuhn saw early fact gathering that was not guided by some "theoretical and methodological belief that permits selection, evaluation and criticism" as a "nearly random activity". He saw the result of undirected research as a morass of "mere facts" that was too complex to be integrated with theory. Senior IS researchers have recognised the problem in IS for decades. For example, "*[w]*e seem to randomly generate research projects with the outcome that we have a scattering of results which presents a

severe problem of pattern recognition" (Dickson, Benbasat & King 1982). More recently it has been claimed that IS is characterised by the problems it studies more than a body of knowledge, or theories (Paul 2002). It may be that some IS research is guided more by the ease with which data may be gathered rather than by other criteria. It appears that, from Kuhn's perspective, IS may be at a very early stage in the development of a discipline.

Elias (1982) referred to the nature of theory in traditional Physics as "law-like theories" rather than "process theories" which may be more appropriate in other sciences. The ideas regarding theory types may be interesting ones to apply to IS, even though not all researchers in the area, including Fitzgerald (2003), would refer to the discipline as a science. The development of theory in IS has been acknowledged as difficult (Fitzgerald 1993; King 1994a; Paul 2002; Fitzgerald 2003), despite a well-known proponent of the philosophy of technology, Bunge, seeing technology as "philosophically productive" (Ihde 2004, p.120), with technological systems putting "forth … philosophically significant theories" (Bunge 1979, p.172). Just one part of the difficulty may be that the origin of IS in technology and its past link with computer science has given those within and outside the discipline an expectation that law-like theories are appropriate for it. However, while the nature of IS stresses organisational issues rather than technical ones (Avison & Fitzgerald 1991; Galliers, 1992; Hirschheim 1992; Fitzgerald 2003), the more recent emphasis on interpretivism has not produced more general theory than the positivist approach (Hirschheim & Klein 2003). Another researcher has proposed a list of theories for IS, but argued for their greater consolidation (Zahedi 2004). Fitzgerald (2003) when discussing theory in IS, distinguished between rules (or laws), evidenced guidelines and normative guidelines, where the latter is "…an interpreted view of something a practitioner developer might consider doing, under appropriate circumstances, but…would not necessarily lead to success" (p. 226). Fitzgerald held that only the latter kind of "theory" was possible in IS. Furthermore, the location of Management Information Systems (MIS) in business schools in both the USA and, to a degree, in Australia, also suggests that law-like theories and scientific method may not be the only, or even the most appropriate, approach for IS. So a mismatch between expectation and achievement as well as the complexity of process theories may account in part for the limited production of theory in IS. Regardless of what kind of theory is produced in IS, or what it is called, there is support for its development (Paul 2002; Fitzgerald 2003).

A decade after Popper referred to the role of theory in scientific progress, a very different view on the development of disciplines emerged. At that time the role of social conditions upon the production and assessment of scientific knowledge was recognised (Whitley 1984a).

Social Processes

Even though Kuhn's views have been referred to in previous discussion on the contribution of theory to the development of a discipline, he is associated more with a different approach. In 1970, at a time of burgeoning science and higher education sectors in many western nations, Kuhn published a seminal analysis of the social process of science, which is still referred to in the IS literature and elsewhere decades later (for example, Wernick & Hall, 2004). Kuhn's treatise, *The Structure of Scientific Revolutions*, influenced the change in attitude to science and the nature of the development of disciplines. Kuhn emphasised the social mechanisms that created a scientific discipline (Ariav, DeSanctis & Moore 1987), such as conferences, journals and academic departments, which have also been referred to as "mechanisms of control".

Hirschheim & Klein (2003) saw the control of rewards and punishments by academics from other disciplines as driving IS research to become more theoretical and less applied. Although such

pressure may increase the acceptance of IS as a discipline, Hirschheim and Klein considered that a less applied orientation reduced IS's relevance to practitioners, and therefore its viability.

A link between knowledge and power was proposed by Foucault (1977), who also recognised the significance of social issues on the nature and development of a discipline. Foucault would see the status of IS as a political issue, rather than the achievement of ontological or epistemological positions. The supporters of this view see IS as becoming a discipline only once sufficient "status has been conferred by institutional practices …(including) the ability to form departments, appoint chairs, organise conferences (and) edit journals…" (Introna 2003), or the achievement of mechanisms of control. The nature of academic leadership is another way that social issues may impact the direction of a discipline and its perceived status (F.Land, personal communication, January 23, 2006). It can be seen that one way to evaluate IS's status as a discipline would be to examine whether it had the mechanisms of control normally associated with a discipline.

Research Methods and Standards

Other researchers have considered research methods and standards in the development of a discipline. This work has led some researchers to examine the relationship between disciplines, particularly reference disciplines. Elias (1982) argued that "high status sciences" retained their position by imposing their methods upon other sciences. He considered it inappropriate for scientific method to be imposed upon newly emerging sciences, particularly as it was developed for, and by, other disciplines. As the emphasis of one discipline may be on physical objects while in another discipline it may be on organisational issues, the scientific methods of some disciplines may be irrelevant to other disciplines.

Different disciplines rank more highly than others in the public and academic mind. As each has its own ideology and values that colour the knowledge they produce, Elias (1982) saw interdisciplinary collaboration as "exceedingly difficult and almost impossible in many cases". He argued that only low status disciplines would take heed of interdisciplinary criticism. Moreover, Elias contended that modelling a low-status discipline on a high-status discipline or its characteristics, in an attempt to gain kudos for the field or researcher, usually fails. If this last proposition is true it may have ramifications for IS because of its close relationship to its reference disciplines. The use of theory and research approaches from reference disciplines may reduce the viability of IS as a discipline while it attempts to improve the rigour of its research. Furthermore, although it has been lamented that the IS literature is not read by those in its reference disciplines (Keen 1991), this characteristic may be a typical of any discipline.

The concept of "restricted and unrestricted science" (Rip 1982) is relevant to an analysis of the nature of IS. In restricted sciences there is considerable control over the "knowledge object", which allows a researcher to tightly restrict the behaviour of the object being studied, whereas in unrestricted science the reverse is true (Rip 1982). Rip argued that the high status of restricted sciences encouraged researchers from unrestricted sciences to become more like a restricted science by importing restrictedness. Signs of a restricted science include use of sophisticated instruments, standardised procedures and empirical generalisations that give increased credibility and allow research assistants or research students to undertake routinised work.

There is evidence that points to IS as being unrestricted, despite technical IS research appearing more restricted. Criticism of IS research approaches indicate that many of the instruments that have been used were not sophisticated, research procedures have been far from standardised (Straub &

Carlson 1989; Boudreau, Gefen & Straub 2001) and a wide range of approaches from reference disciplines have been considered appropriate (Ahituv & Neumann 1986; Culnan & Swanson 1986).

Although greater standardisation of some research procedures has been seen more recently, at a time when it has been suggested that IS is now itself a reference discipline (Baskerville & Myers 2002), other researchers have pointed to the difficulty in reaching consensus on the most appropriate methods for IS (for example, Hirschheim & Klein 2003). Even though the view of IS's development by practitioners is an external perspective, and this paper has restricted itself to the internal view from IS academics, there will also be an internal perspective on the relevance and quality of IS teaching to future and current practitioners and other students.

Research education itself may be seen as a standardised procedure where it is specialised to a particular discipline. Relatively recent figures indicated that IS researchers in the USA had gained their highest degree across a broad range of disciplines (Walstrom, Hardgrave & Wilson 1995), revealing that the research training process for IS academics trained prior to 1995 in that nation was far from standardised. It appears that a similar diversity was found in the education of Australian IS researchers to 1996, but that this diversity has narrowed since then. An anonymous reviewer of this paper contended that the diverse educational backgrounds of IS's "fathers of the field" are significant when examining the current nature of IS.

In addition to *theory*, *social issues* and *research methods and standards*, other approaches were identified in a review of the literature as having been proposed as contributing to an understanding of the nature and development of a discipline. These were more joint approaches, which combined two or more other approaches.

Combined Approaches to Explain Disciplinary Development

There is majority support for examining both the body of knowledge along with the social processes, when considering the development of a discipline (Becher 1994), as "we cannot…artificially separate the …substantive content from … social behaviour" (de Solla Price 1970). Becher (1987) examined the nature of three different disciplines by examining their tacit knowledge (which derives from the body of knowledge) along with their linguistic behaviour (a social process). Like Tardif (1989), Paul (2002) and Hirschheim and Klein (2003), Fitzgerald (2003) considered that a discipline required a core body of knowledge. However, Fitzgerald and Paul saw a body of knowledge as being more than an agreed set of topics, but to include also the set of laws, rules or evidenced guidelines, that is, theory. Fitzgerald postulated that IS had "the trappings of a discipline...*[such as]* mechanisms of control *[which are social processes]*, but without the core body of knowledge or agreed theory" (2003, p.226). Consequently Fitzgerald viewed IS as a "perspective" rather than a discipline.

Hirschheim and Klein (2003) saw the IS body of knowledge as incorporating some social processes and theory, when they proposed that its four components were technical, theoretical, ethical and applicative knowledge. Hirschheim and Klein saw the development of applicative knowledge, that "required …*[the application of]* theoretical knowledge to specific circumstances" (p. 266), as being necessary to reach understanding and consensus in IS. They considered that the limited extent of applicative knowledge in IS threatened the viability of the discipline. The discourse needed to develop the body of knowledge for IS, particularly applicative knowledge, would increase communication and IS's relevance, both internally to the academic discipline and externally. In later work, Klein and Hirschheim (2006) saw IS at risk both because it was made up internally of several "Communities of Practice and Knowing" (CoP&K), each with different values and

legitimacy criteria, and because there was limited connection from academic IS's internal CoP&Ks to the outside. However, discourse would benefit the development of the discipline by helping to derive a common language across groups impacted by IS, reducing the state of fragmentation in IS and overcoming its significant communication gaps (Hirschheim & Klein 2003).

Shinn (1982) considered concepts that related social processes, research procedures and theory development when he examined the intellectual and social structure of a range of disciplines, in particular looking at the intellectual division of labour. He found some disciplines to be highly formalised, with a dichotomy between the gathering and collation of findings on the one hand, and experimentation, theory and hypothesis on the other. One would expect that the more restricted a science (Rip 1982) then the more formalised its intellectual and social structure. As expected from its degree of restrictedness, IS is not as formalised in this way as are some other disciplines. Where interpretivist research is undertaken in IS, the data gathering and the theory building may be interleaved. Even in IS positivist investigations it is likely that the chief investigator/s will be involved in all stages of the process. The latter characteristic is partly dependent on the limited success of IS in attracting research funds (Ridley *et al.* 1998), which relates in turn to the perceived status of the discipline. Consequently, relatively few academic IS researchers have funding to employ assistants to carry out some of the research tasks.

The work of Chubin and Connolly (1982) allows further understanding of the combined pressures that have acted on the IS discipline. The authors argued that "research trails" become institutionalised by offering potential rewards such as legitimacy and access to resources. On the other hand, "tinkering" with new ideas or novel developments is normally opposed. Research trails are likely to use the epistemologies, research strategies, theory and perhaps even the topics of existing established research of reference disciplines. In IS, those who follow the existing research trails that were established by the reference disciplines may be more likely to be rewarded with tenure, promotion and access to research grants, as rigour is easier to demonstrate. Efforts to establish appropriate independent research approaches and traditions for IS may be seen as tinkering, as it is more difficult to claim that work is rigorous if it does not follow established traditions. Yet Elias has argued (1982) that greater independence of a discipline leads to its development, and, it is assumed, eventual research rewards. It is possible that the path to the development of IS may involve breaking with some traditions established by the reference disciplines.

Whitley's Theory of Scientific Change

Whitley's theory of scientific change (1984b), which viewed disciplinary development as a social process in combination with other approaches, has been applied to many disciplines, including IS (Banville & Landry 1992; Checkland & Holwell 1998). Whitley categorised some sciences as highly professionalised, with high task certainty, routinisation of activities and division of labour, a categorisation that echoed the work of Biglan (1973), Kolb (1981), Rip (1982) and Shinn (1982). Kuhn's (1970) "normal science" fell into this category. However, other sciences were not highly professionalised, with high task uncertainty, decentralised control of work process and limited routinisation of tasks. Where a discipline was not highly professionalised, local contingencies had high impact, such as the influence of local political pressure. Ruscio (1987) also found that local factors resulted in substantial variations among universities for the same discipline. Non-professionalised disciplines may account for Ruscio's finding.

In disciplines that are not highly professionalised, researchers investigate disparate problems that are likely to vary in nature and approach to those of concern to practitioners. Researchers work in

flat non-hierarchical groups, or independently, rather than in highly structured teams with a clear division of tasks. IS appears to fit the mould of a discipline that is not highly professionalised. Furthermore, if local contingencies are likely to have high impact on IS, it would be expected that considerable variation would exist in the nature of IS research between different universities and regions. There is evidence of considerable variation in the nature of IS research between nations**,** IS curricula and IS research education.

Whitley (1984b) suggested that three conditions needed to exist for the establishment of distinct scientific fields. These were the need for:

- Scientific reputations to become socially prestigious and to "control critical rewards";
- Establishing standards of research competence and skills, and
- A unique symbol system to allow exclusion of outsiders and unambiguous communication between initiates within the field.

Whitley's first condition is a social process and relates to mechanisms of control. Scientific reputations are established, and critical rewards are obtained, through publication records and success at attracting research funding (Mingers & Stowell 1999). There were more IS publication outlets available in 1995 than in 1980 (Cule & Senn 1995), and many more in recent years (Hirschheim & Klein 2003). In general, these publication outlets are now administered by fellow IS researchers. However, access to funding remains tenuous while external funding decisions are made by individuals outside the discipline, as has happened with the allocation of Australian Research Council grants (Ridley 1997) during much of the development of the IS discipline in Australia.

Whitley's second condition, the establishment of research skills (and standards), appears to be one component of a core body of knowledge, just as in the preceding discussion it has been seen that theory is also a component of the body of knowledge. Ongoing debates regarding the quality of IS research and appropriate epistemologies and methodologies (Benbasat & Weber 1996; Boudreau, Gefen & Straub 2001) are signs that activity is taking place regarding Whitley's second criterion for the establishment of a field, but that it has not been resolved. However, more recently there have been some signs of increasing consensus.

Whitley's third condition, the existence of a unique symbol set, appears to be another component of a core body of knowledge. Whitley's third criterion for the establishment of a field is hard to meet as long as reference disciplines remain important to IS. Because so many reference disciplines inform IS research (Walstrom, Hardgrave & Wilson 1995; Baskerville & Myers 2002) and the symbolic systems of each vary and compete, a dedicated and accepted IS symbol system has yet to emerge. The FRISCO (Framework of Information System Concepts) report that was produced in 1996 to clarify important IS definitions (Verrijn-Stuart 2001) is one demonstration of attempts to satisfy the third criterion.

Interestingly, however, two other components that were identified in earlier discussion of the literature as contributing to a discipline's body of knowledge fall outside Whitley's three conditions for the establishment of a distinct scientific field. Theory (or laws, rules and evidenced guidelines) is not included within Whitley's conditions for the development of a distinct field; nor is an agreed set of topics.

In earlier work, Whitley (1984a) conceptualised seven stable categories to classify variations in the degree of mutual dependence between researchers of a field as against variations in the degree of

task uncertainty. These seven categories can be used to differentiate the nature of one discipline from another. The categories have been applied to IS by researchers for two decades.

Researcher mutual dependency was defined as "…dependence upon particular groups of colleagues to make competent contributions to collective intellectual goals…", while task uncertainty referred to "…the extent to which work techniques are well understood and produce reliable results…" (Whitley 1984a, p.781). Where task uncertainty is low, there is an "established set of research techniques…" which "…can be acquired through formal training programmes…" where " …success is easy to determine" (Whitley 1984a, p.781). Of the seven categories, IS has been classified as a fragmented adhocracy (Culnan & Swanson 1986; Banville & Landry 1992; Culnan, Swanson & Keller 1993; Swanson & Ramiller 1993; Checkland & Holwell 1998; Hirschheim, Klein & Lyytinen (1996); Hirschheim & Klein 2003; Kanungo 2004). Fragmented adhocracies display high task uncertainty with low researcher mutual dependence, so researchers from these disciplines make diffuse contributions to fluid goals that are contingent on local pressures (Whitley 1984a). Another characteristic of fragmented adhocracies is their openness to the general public (Whitley 1984a), as they tend not to have unique symbol sets that exclude the uninitiated. It is suggested that the characteristics of IS as a fragmented adhocracy work against it becoming a distinct scientific field.

It has been seen in a review of the literature that the establishment of *theory*, *social processes*, *research methods and standards*, *a unique symbol set* and a set of *key topics*, have been used to explain the nature and development of disciplines in the past. A *core body of knowledge* appears to subsume *theories*, *research methods and standards*, *the existence of a unique symbol set* and a *set of key topics*. An examination of the relationship between the impact of local pressures and the degree of professionalism has also been used to help account for the nature of disciplines.

Although little literature was found that related teaching issues to the state of IS in universities, as an internal academic perspective must include teaching issues, any framework developed will need to be capable of encompassing this area. It is argued that for completeness, both the relevance and quality of teaching need to be considered. The set of key topics must denote then, not only research topics but also relevant teaching topics, and will be one means of achieving interaction between the internal and external perspective of IS. Like research, teaching quality is also concerned with methods and standards.

Motivation to Understand the Nature and Development of a Discipline

The author de Solla Price (1961, 1963) believed it is possible to trace the history of a discipline through its artefacts, which include the number of researchers as well as the number of papers, journals and scientific societies it engenders. He referred to the difficulty of a new field in making progress, and the characteristic that large disciplines grow faster than small (1963). This may be because large disciplines are more able to control critical rewards and exert political power, and so meet the first criterion for Whitley's establishment of scientific fields, controlling critical rewards through a range of mechanisms of control.

Taking a disciplinary perspective results in cross-fertilisation and an increased sense of unity (Becher 1994), which brings other benefits in turn. Disciplinary cultures frequently span institutional and national boundaries (Becher 1994). A social mechanism, the "invisible college", was described by de Solla Price (1961; 1963). Culnan (1987) defined invisible colleges as the clustering of researchers into informal networks "which tend to concentrate on examining common questions in common ways". The author, de Solla Price, saw membership of an invisible college as

conferring power and status on an individual and the network (1963). As these networks of researchers are best placed to lobby for better access to resources and funds (Ridley 1997) than individuals, both individuals and researcher networks are likely to be advantaged by an increased awareness and understanding of their discipline.

The following brief examinations of two other disciplines are presented to demonstrate both that it is possible to analyse disciplines from the perspective of their development, and that it is advantageous to do so. The reader is asked to note reference to approaches to clarify the nature and development of disciplines in the following vignettes, as identified from the review of the literature presented earlier.

Vignettes of Disciplinary Development

An examination of the early development of two other related disciplines may help clarify the development of IS.

Management

Whitley (1984a) tracked the development of Management as a discipline. Like IS, Management has been categorised as a fragmented adhocracy, but it has had a longer history. Management originated as a distinct discipline in around 1960. Until the late 1950s, United States (US) business schools taught material from economics, mathematics and psychology. The distinct labour market that emerged after a critical mass of Management doctorates graduated, allowed the specification of a Management doctorate and scholarly repute as criteria for appointment to academic positions and senior posts in Management. These developments allowed Management researchers to distance themselves from lay criteria and standards and increased their degree of mutual dependence. Consequentially these changes limited their need to seek approval from non-Management audiences for reputations and rewards (Whitley 1984a). It can be seen in this brief vignette that a specific doctoral qualification in management, and the achievement of a critical mass of doctoral graduates, were keys that led to the development of the Management discipline.

Many management sub-disciplines experienced a need to debate the most appropriate traditions to direct their research and choice of research methods. This has been true of organisational behaviour, accounting, marketing, strategic management and policy, operations management and operations research (Klein, Hirschheim & Nissen 1991). It is little surprise then that IS has not escaped similar debate.

Computer Science

Computer Science is another discipline that can be used to demonstrate that the concerns of the IS community for the future of its discipline are not unique. Computer Science experienced problems associated with the youth of its academics (Gries & Marsh 1988), the diverse backgrounds of its researchers (Hopcroft 1987), and a need to "cease its largely inward-looking activities and branch outward" (Gries, Walker & Young 1989). Doubts were expressed later about the future of the discipline and fears that Computer Science may become irrelevant (Freeman 1995). There were calls for Computer Science to develop its own disciplinary characteristics and to avoid emulating high status disciplines like Physics (Hartmanis 1995b). Other researchers in the same discipline debated the nature of Computer Science and tried to determine if it was a subset of engineering, science, mathematics or something more (Denning *et al.* 1989; Hartmanis 1995a). King (1994a)

observed that the majority of Computer Science departments were found within engineering schools, and that very few were completely independent with the same status as other schools.

AN ANALYSIS OF LITERATURE TO DEVELOP A FRAMEWORK

After having examined IS and non-IS literature that reviewed approaches to the development of disciplines, and considered two examples from related disciplines, a method was sought to develop a framework that could be used to guide the examination, to be conducted elsewhere, of the nature and development of IS in Australian universities. Not only did the components of the framework need to be identified, along with their relationship, but an evaluation was sought of whether a framework of the development of a discipline from the general literature was consistent with that developed from the IS literature. In other words, would IS and non-IS researchers share a common view of the components that contributed to the nature and development of a discipline? It was reasoned that if the perspective of each group of researchers on the nature and development of a discipline was consistent, then this would act to validate the framework derived from the literature.

Methodology

A thematic analysis process for a structured review was followed (Dixon-Woods, Agarwal, Jones, Young & Sutton 2005), where relevant literature previously identified was classified as having discussed one or more approaches that contributed to an understanding of disciplinary development. A data-driven approach was adopted, where the themes emerged from the data. The analysis did not reflect the frequency of the themes, but instead accepted themes that offered a "high level of explanatory value" (Dixon-Woods *et al.* 2005, p. 47). The relationship between the identified components was also examined. As it was considered necessary to examine the views of both researchers from IS and other disciplines, it is acknowledged that any classification of approaches to disciplinary development derived from the literature is unlikely to be complete, due to the quantity of publications available on the topic. However, it is argued that only sufficient analysis is needed to identify the main issues when reviewing disciplinary development, until theoretical saturation is achieved, as is done when working towards concept development in primary qualitative research (Dixon-Woods *et al*. 2005). Therefore any omission of literature in the area is unlikely to weaken the analysis and classification process. The purpose of distinguishing the themes identified from the IS literature from those of the wider literature was to allow an evaluation of the degree of consistency between IS researchers and those from other disciplines. If the framework developed matched the components identified from both groups of literature, and the relationship among the components, then the robustness of the framework would be strengthened.

As classification is a largely subjective process, two trained IS researchers categorised the literature independently. Discussion took place where the classification differed, until agreement was reached. The major themes derived from the literature, *Social Processes* and *Core Body of Knowledge,* were used for analysis. As foreshadowed, the latter category was broken down into four subgroups, *Research and Teaching Methods and Standards*, *Unique Symbol Set*, *Key Research and Teaching Topics* and *Theoretical Issues*. To acknowledge the importance to IS of providing professional training, any literature that considered teaching methods and quality in the development of the discipline, was grouped with the *Research and Teaching Methods and Standards* category, while literature on teaching relevance was grouped with *Key Research and Teaching Topics*.

The *Impact of Local Influences* was also sought. A record was made for each reference to these themes, by author. The results were further delineated by whether the author came from the IS

discipline or elsewhere, as determined by the publication outlet. The relationship between the themes was captured by recording the combination of issues discussed with reference to disciplinary development, for each author.

Results

Table 1 sets out the results of the analysis of the literature, where the components explicitly examined in discussion of the nature and development of disciplines were identified and then classified. Themes taken from a review of the IS literature have been distinguished from those that were derived from the more general literature. The order of listing in the table matches that followed in the earlier discussion.

		Core Body of Knowledge				
Published Research	Social processes	Research & teaching methods & standards	Unique symbol set for communication	Research & teaching key topics	Theoretical issues	Local influences
Popper 1959						
Klein, Hirschheim & Nissen 1991	●					
Bunge 1971						
Foucault 1977						
Keen 1991	●					
Paul 2002				●	●	
Wernick & Hall 2004				o		
Kuhn 1970		o			o	
Elias 1982		o		o	o	
Becher 1994	o			o		
Hirschheim & Klein 2003	●		●		●	
de Sola Price (1961, 1963, 1970)	o			o		
Tardif (1989)				o		
Fitzgerald (2003)	●			●	●	
Rip (1982)		o		o		
Shinn (1982)	o	o			o	
Ridley *et al.* (1998)	•	●				
Chubin & Connolly (1982)	o	o		o	o	
Banville & Landry (1992)	●					●

Checkland & Holwell (1998)	●					●
Biglan (1973)				o		
Kolb (1981)		o				
Whitley (1984b)	o	o	o			o
Ruscio (1987)						o
Cule & Senn (1995)	●					
Mingers & Stowell (1999)	●					
Verrijn-Stuart (2001)			●			
Culnan & Swanson (1986)	●					●
Culnan, Swanson & Keller (1993)	●					●
Swanson & Ramiller (1993)	●					●
Kanungo (2004)	●					●
Culnan (1987)	●	●				

● Derived from IS literature
o Derived from non-IS literature

Table 1 Identification from Literature of Framework Components for Disciplinary Development

Discussion and Findings

As all the categories were found in both the IS and the general literature, this finding was interpreted to mean that both groups shared a common view of the components used for explaining the nature and development of a discipline. Consequently, it was assumed that the components identified were robust, and appropriate for inclusion in a framework of the development of a discipline. From the number of studies examined, and the results, it was assumed that saturation of topics had been reached. As many authors identified more than one component, a combination of components was considered most appropriate to account for the nature and development of the IS discipline.

FRAMEWORK DEVELOPMENT

A framework to account for the nature and development of a discipline was prepared, using the components and their relationships identified in the review and analysis of the literature. Whitley's theory of scientific change and related concepts influenced the development of the theoretical framework. The framework has been used to consider the historical and present position of IS in Australian universities, in combination with a "body of knowledge", using Fitzgerald's understanding of the term. The two constructs discussed below from Whitley were utilised in the framework.

The first construct that sets out Whitley's three conditions for the establishment of a distinct scientific field has been used in part for the theoretical framework. As set out earlier, these are *a.* Scientific reputations to become socially prestigious and to "control critical rewards"; *b.* Establishing standards of research competence and skills, and *c.* A unique symbol system to allow exclusion of outsiders and unambiguous communication between initiates within the field.

As outlined earlier, the first condition from Whitley is a collection of mechanisms of control, or social processes, while the second and third conditions relate in part to a core body of knowledge. However, Whitley's second and third conditions were found insufficient to cover all aspects of a discipline's body of knowledge. For example, the second condition excluded teaching issues, even though IS academic teaching is largely the means by which an understanding of the discipline is imparted to future academics and practitioners. As demonstrated in the analysis of the literature, the "laws, rules or evidenced guidelines" component of "body of knowledge" (Fitzgerald 2003; Paul 2002) which has not been incorporated into the first construct above, also needs to be considered when examining progress towards the development of IS in Australia. Furthermore, key topics were also shown by analysis to be an essential component of the body of knowledge, and included both relevant research and teaching topics. The second construct concerns the degree of "professionalisation" of the discipline, which is expected to decrease as the impact of local contingencies increases.

Consequently, a two-part framework was developed as a result of the literature analysis that includes *Mechanisms of Control* for the discipline and the *Core Body of Knowledge*, both considered against time. The framework has been used to guide some of the regional data collection and analysis for the Australian study. The second condition from Whitley was adapted and incorporated into the *Core Body of Knowledge*, as *Research and Teaching Methods and Standards*, while the third condition was included as *Unique Symbol Set*. Two additional components, *Laws, Rules and Evidenced Guidelines*, and *Research and Teaching Key topics* have also been included in the framework. Figure 1A illustrates the first part of the framework used for the study, and sets out the components that characterise the nature and development of a discipline. The second part of the framework is set out in Figure 1B, which shows the inverse relationship between the impact of local contingencies on the IS discipline and the degree of professionalism.

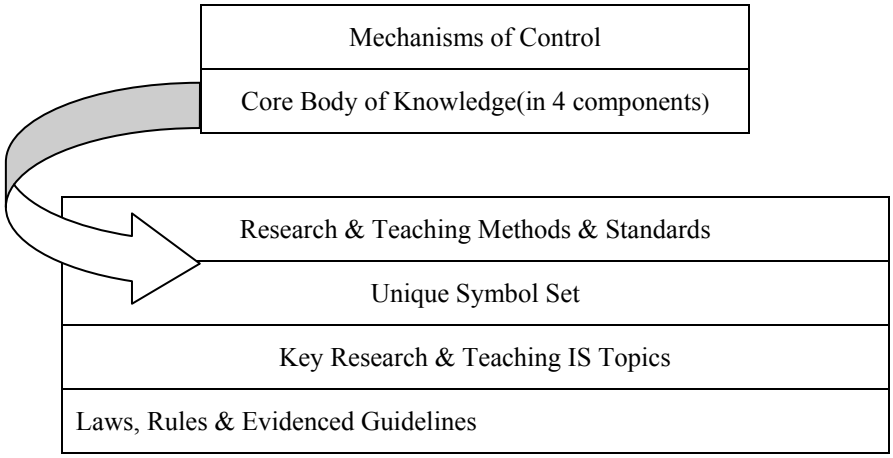

Figure 1A Framework for Study: Components of Academic Discipline

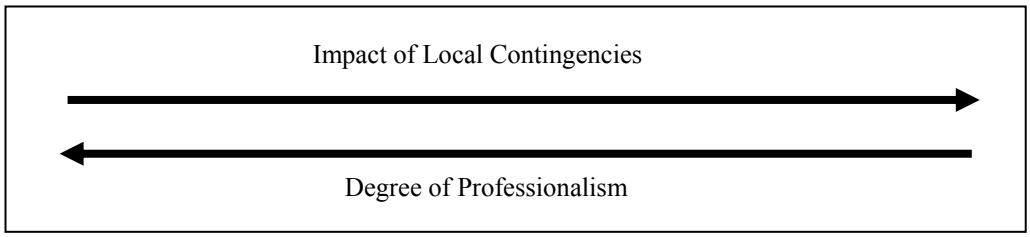

Figure 1B Framework for Study: Inverse Relationship between Impact of Local Contingencies on IS Discipline and Degree of Professionalism

CONCLUSIONS

A body of literature exists that examines the theory of the development of disciplines. This literature suggests that the development of IS in Australian universities should not be viewed as a unique case, but instead a range of pressures need to be considered, that act on the discipline. A brief overview of the early development of the Management and Computer Science disciplines was presented, to illustrate the development of two disciplines related to IS. Although some reference has been made in IS to theory on the nature and development of disciplines, very little use of the material has been made to provide a context within which to view the past and present nature and position of IS in Australian universities.

The project reported on elsewhere in this volume gathered data across a range of dimensions for universities in each large region in Australia. It has been argued that if such data collection is to be utilised in a strategic way to increase access to resources for the IS discipline, then it will be necessary to integrate the data and findings from regions across the dimensions, so that the

relationships within, between and among the regions and dimensions can be analysed, and the contributing factors better understood. A theoretical framework to guide data collection and analysis was developed from an analysis of the IS and non-IS literature on the development of disciplines, and presented in this paper. As the framework's components could be derived independently from both the IS and non-IS literature, this characteristic strengthened the validity of the framework. The framework will integrate different aspects of the broader study, and provide a common way of looking at data collected over a range of dimensions from a range of regions in Australian universities.

Data gathered from universities in the regions around Australia can be used to assess the extent to which *mechanisms of control* have been established in Australian IS, along with the four components of the *body of knowledge* (*research and teaching methods and standards*, the existence of a *unique symbol set*, *key research and teaching topics* and *laws, rules and evidenced guidelines*). In addition, the relationship between the *impact of local contingencies* and the *degree of professionalism* can be evaluated through an analysis of the extent of variation in the nature of IS in universities among the states of Australia over time and at present. Together these two constructs will provide a means of tracking progress in the state and development of the IS discipline in Australian universities in the past and future, and identify those issues that hinder progress.

Future work will analyse the utility of the framework, based on its effectiveness to characterise the development of IS in Australian universities. The external view of the development of IS from those who are not IS academics will also need to be evaluated at a future time. Before applying the framework to examine the development of IS in other regions of the world, it may be necessary for further refinement, based on the outcomes from the framework's application to the Australian study.

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