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**CONSTITUTING THE SIGNIFICANCE AND VALUE OF RESEARCH:
VIEWS FROM INFORMATION TECHNOLOGY ACADEMICS
AND INDUSTRY PROFESSIONALS**

Author for correspondence:

Dr Christine Bruce
Associate Professor and Director, Teaching and Learning
Faculty of Information Technology
Queensland University of Technology
Box 2434, Brisbane 4001, AUSTRALIA
Phone: +61 7 3864-2780; Fax: +61 7 3864-9279

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Christine Bruce, Binh Pham, Ian Stoodley

*Centre for Information Technology Innovation, Faculty of Information Technology,
Queensland University of Technology, Brisbane, Australia*

Abstract: The IT research community, comprising both academic and industry stakeholders, is responding to national and international imperatives that challenge disparate groups to work together. In this article we show how, within both academic and industrial contexts, researchers interpret, or constitute, the significance and value of research in different ways. Important aspects of these differences may be described in terms of what comes to the foreground when members of the community are asked to consider the significance of projects; and what recedes to the background, ultimately forming a ‘perceptual boundary’ beyond which they do not see. The study reported here represents a first step in understanding one dimension of the ‘collective consciousness’ of the IT research community. The framework developed may contribute to the widening awareness of more experienced researchers, as well as revealing something of the character of the research community to those engaged in researcher training, education and development.

CONSTITUTING THE SIGNIFICANCE AND VALUE OF RESEARCH: VIEWS FROM THE INFORMATION TECHNOLOGY RESEARCH COMMUNITY

Christine Bruce, Binh Pham, Ian Stoodley

*Centre for Information Technology Innovation, Faculty of Information Technology,
Queensland University of Technology, Brisbane, Australia*

Introduction

In the last twenty years the information technology research community has diversified considerably. Today it incorporates mathematicians, engineers and social scientists, amongst others, many of whom have multi-disciplinary interests. Academic and industry researchers investigate domains as diverse as programming, data mining, cryptography, database architecture, information security, information science, e-commerce, information management, multimedia and robotics. They engage in equally diverse research practices, adopting positivist, interpretative and naturalistic approaches in accordance with how they see the world. The ever widening range of sub-domains suggests that the research territory is becoming increasingly fragmented, and that researchers' ways of seeing aspects of their research endeavour are diversifying accordingly.

This study uncovers variation in what academic and industry researchers consider to be significant and valuable contributions to the field of information technology research. Our project has begun to reveal the different perceptual worlds in the information technology (IT) research community. It represents a first step in understanding one dimension of the 'collective consciousness' of the IT research community, and lays a foundation for further investigation of IT researchers' collective consciousness.

Contemporary research, including IT research, is changing to encompass inter- and intra-disciplinary collaboration, as well as academic and industry research partnerships (Jacob & Hellstrom, 2000; Harman, 2001). In the Australian context, where this research was conducted, such collaborations are actively supported by government agendas and funding mechanisms, as well as by internal university policies (Kemp, 1999; Sara, 1998; Pham, 2000). Our interest in researchers' different ways of seeing significance and value stems from the informal and formal importance assigned to the significance of projects from inception, when they are being informally discussed by colleagues; throughout their development and reporting, when they are assessed by peers; and post-completion, when they are taken up or

not by other researchers or industry end users. We see this as a first step in exploring dimensions of the collective consciousness of IT research.

The relatively early stage of formation of the IT research community means it is difficult to judge without formal study the current nature of its collective consciousness. Researchers' collective consciousness has been defined by Bowden and Marton (1998) as the different ways in which a group of researchers see their research object. They suggest that this shared research object is a prerequisite for collaborative research. They describe the collective consciousness of the research community in terms of the degree of awareness amongst members of each others' ways of seeing (Bowden & Marton, 1998, p. 196). The collective consciousness seems to be influenced by multiple aspects of researchers' experience. We are taking the view that researchers' collective consciousness may involve not only ways of seeing their research object, but also ways of seeing other dimensions of research such as the significance and value of projects. We are also adopting the stance that learning at the collective level is facilitated, or hindered, by particular understandings of the research endeavour that are constituted within, or experienced by, members of the research community.

In developing this project we sought to design an investigation that would allow us to gain access to the different ways of experiencing the significance and value of IT research and, in the longer term, to help IT researchers extend their repertoire of ways of seeing to understand and include those of their colleagues. The insights into ways of constituting significance and value presented here are offered as a framework within which researchers, both experienced and new, may further understand themselves and each other. The framework may allow academic and industry partners to critique their own reasons for engaging in particular forms of IT research. It may also be used to facilitate inter-disciplinary research as well as collaboration between IT groups, by making explicit varying experience of one aspect of the research agenda.

For the purposes of our project, we are using the term '*IT research community*' to include the wide range of stakeholders that, nationally and internationally, participate in IT research. This investigation focuses attention on a localised *community of IT researchers* in order to begin to uncover one aspect of the collective consciousness of the IT research community, that is variation in ways of seeing the significance and value of research projects.

Throughout the paper the term *IT researcher* refers to both academics and industry professionals.

Investigating ways of constituting significance and value amongst IT researchers

Since the early 1970s, phenomenography (Marton & Booth, 1997; Bowden & Walsh, 2000) has been used extensively, and successfully, to investigate variation in ways of seeing or experiencing phenomena associated with learning amongst school and university students. These techniques are now beginning to be used to investigate the collective consciousness of research communities (Bowden & Marton, 1998), including academic conceptions of research and scholarship (Brew, 1998, 2001), ways of seeing the research object amongst particular research communities (Baillie, 2001; Bruce & Pham, 2001; Bruce, 2002), and research students' ways of seeing (Kiley, 2000; Bruce, 1992, 2001). It is a natural extension of phenomenography to investigate the character of learning amongst the community of researchers. We have also adopted the approach as the most appropriate means of exploring differences in ways of constituting the significance and value of research. Phenomenographic investigations explore the interrelationship between people and the world, striving to understand the way people look at, or are aware of, some aspect of the world, and also the way that aspect of the world appears to them. In this investigation, therefore, exploring ways of seeing significance and value involves exploring the way in which significant and valuable research projects are looked at, and how they appear. The qualities of "significance" and "value" are attributed by the researcher, or rather significance and value is 'constituted' by researchers and research projects. The latter term is preferred, as significance and value is considered to be formed as a result of a dialectical relationship between the researchers and the research projects, rather than a one-way relationship from researcher to research project.

Participants

The eighteen participants in our study were IT researchers in South East Queensland (see Table I). They represented both genders and a cross section of sub-disciplines, age groups and experience. Sub-disciplines from which participants were drawn included Computer Science, Data Communications, Information Systems and Information Management. The participant profile was designed to maximize the possibility of eliciting different ways of conceiving the value and significance of particular kinds of IT projects.

[Table I : Participant profile]

Of the eleven academic researchers, eight were male and three female. Most were either over fifty or under thirty; two were aged between thirty and forty, and one between forty and fifty. Participants were drawn from the sub disciplines listed above. Most were experienced researchers; three were students and one was an ‘early career’ researcher (having completed a PhD in the last 5 years). Their research interests were spread widely over areas such as the computer-human interface, information use, information security and programming languages.

Of the seven industry professionals, four were male and three female. Five were aged between thirty and fifty. Each of the sub-disciplines of the academic researchers was represented, except Data Communications. Their research experience was varied. Three described their research responsibilities as “management of an applied research group”, “market analysis” and “software development”. Professional interests across the group included information management, literacy and education; software assessment, training and testing; emerging technologies; information delivery through portal and extranet technology; internet solutions for businesses; and software engineering. Their application environments included small businesses as well as large organizations.

Due to the small sample sizes, no comparison between sub groups within the academic and industry participant groups has been attempted.

Data gathering and analysis

The eighteen researchers each conversed with an interviewer about the significance and value of IT research for about thirty minutes. The semi-structured interview protocol included open-ended questions designed to elicit differences in the attribution of significance and value to IT research. Each question was focussed enough to obtain meaningful responses in relation to the aim while being broad enough to do this without forcing a particular structure, or way of responding, upon participants. After completion of the interview, tapes were transcribed verbatim and checked by the interviewer. Copies of the interview transcripts were sent to the participants for information and comment.

In the tradition of phenomenographic research, the interview conversation opened with directing participants towards their own research experience. Focus then shifted to specific projects demonstrating a range of different types of IT research, represented by extracts from

published articles. Finally, a more abstract approach was taken to probing participants' views; participants were asked how they decided whether projects were significant or valuable. Each question served as an 'opening' of a particular phase of the interview. Throughout each phase the interviewer developed a trail of further questions in order to achieve a shared understanding of participants' perspectives. Interviews of both groups of participants followed the same structure. As varying meanings associated with significance and value were probed, the interviews may be considered an early phase of the analysis.

Subsequent analysis was an iterative process involving a team of three researchers. From transcriptions of the interviews, the research team sought (1) the variation in meaning associated with the idea of significance and value, and (2) an understanding of the awareness structures through which participants experienced significance and value. The analyses for each group of participants, representing academia and industry, were conducted separately.

In the following sections we present participants' different ways of seeing what constitutes significant and valuable IT research. In each category we describe one of the ways in which academic or industry researchers see significance and value, as well as how significance and value appears to these groups. Each category represents one lens through which a project might be viewed. While we have applied emerging phenomenographic understandings of the character of conceptions and phenomenon (Marton, 2000) to our analysis, we are aware that the phenomenon we have investigated has also contributed to the final character of the framework through which it is described. This is evident through the articulation of the external horizon as a perceptual boundary, and through the discovery of both stable and variable elements in the internal horizon. Each category thus consists of a referential component, in which the meaning of the category is captured, and a structural component, in which the awareness structure associated with the referential component is made explicit. We convey the referential component through the title of the categories and the brief descriptions accompanying them. We depict the structural component through the diagrams and in the specification of the focus and perceptual boundaries associated with each category.

In the structural component of each category, the awareness structure (Marton, 2000) is delimited in terms of an internal horizon, with stable and variable components, and an external horizon. The *External Horizon* represents the outer limits, or perceptual boundary, of the participants' ways of seeing and identifies that part of the world beyond which

participants, who are looking at the world in a particular way, do not see. The *Internal Horizon* represents the focus of the participants' attention, that which is figural in awareness. The *stable aspect* in the internal horizon of each category remains constant across any possible subcategories and in this sense is the central component in identifying the particular way of seeing. The *variable aspects* in each way of seeing serve to distinguish between subcategories.

In the descriptions which follow, each category is accompanied by a diagram illustrating the awareness structure with which it is associated. Figure 1 shows how the external horizon (perceptual boundary) and internal horizon (focus), consisting of stable and variable components, are graphically depicted. Where two awareness structures are presented, the academic researchers are represented on the left and the industry researchers are represented on the right.

[Figure 1 : Key to the components of the awareness structure for each category]

How is significance and value constituted amongst IT academics and industry researchers?

[In the following sections, references attached to illustrative quotes supply the interview number, transcript page number and approximate position on the page eg. 10.6b refers to interview 10, p.6, section b. 'A' refers to academic, 'I' to industry researchers.]

Our investigation has revealed that, even amongst members of what might be considered to be the same research community, significance and value are not constituted in the same way. For academic and industry researchers, the same projects might appear to be significant or valuable for widely varying reasons.

Referring to Project A

... it's looking at a fundamental problem that we don't have a solution for (A9.6a)

... this has a lot of applications in computer robotics and vision and stuff like that which would be very useful in maybe ... automatic manufacturing. (I18.3a)

Referring to Project C

... any field of endeavour has to have a fundamental understanding of sharing of concepts, so that people can work in that field of endeavour together ... (A10.4a)

... no matter what organisation you're in these days, information is key. And anything that can improve that obviously has a commercial benefit. (I13.5d)

Even amongst IT researchers from different milieus, the same project may be seen to be significant for different reasons:

Referring to Project D

... anything that's going to help with computer vision ... is going to facilitate more theories. This one here itself is not going to be a break-through, it's not going to be a landmark paper, but this one is going to lead to other things, other research, and stimulate that idea and contribute to the knowledge and it will all build up together ... (A7.5d)

... it may appear insignificant in terms of you don't know exactly what applications it might be useful for, but still it's looking at a fundamental problem that we don't have a solution for ... (A9.5d)

Referring to Project E

I think this is again really important commercially because obviously you put a lot of work into the initial development and then ... ideally if you can use some of that legacy software, it saves in terms of time and dollars, so yes I think that that's ... an important research area in a commercial sense. (I13.5d)

... this is ... very useful ... in my opinion. This is one of the problems that I think most IT companies have constantly solved ... So the sorts of issues that this particular type of research aims to solve are extremely real and probably one of the biggest issues that I think nearly every ... software company that's been on the planet for probably more than 5 years is interested and has an issue solving. (I16.7a)

Concomitantly, the same project might appear significant to some, but not to others who interpret significance differently. Following are examples associated with two projects:

Referring to Project B

... seems to lack substance, in fact ... it seems to very much be the idea of one person's view without empirical information to back up that view ... (A6.4a)

I think this is interesting. I found this quite interesting reading it and I think that it is really important to look at ... the human side of what is the impact of this re-engineering, and I think that is going to be really important, firms are much more focused these days ... on how their people cope with the changes they impose on them ... and ... there's lots of people that I can think of who would be interested in that, both in this firm and outside. (I15.3a)

Referring to Project E

... not much is going to come out of it ... when I can clearly see that whatever is going to come out is going to be very similar to what everybody else is going to find ... it doesn't depend so much on the team doing the research ... take anyone, give them that problem, and they will come up with similar solutions ... this kind of research is gonna find something that everybody who tried it would find the solution for, so ... to me, this is probably the least valid ... (A9.6b)

... very useful things in my opinion. This is one of the problems that I think most IT companies have constantly solved. (I16.7a)

Each category in this analysis is exclusive of the others, however it is possible when considering a particular research project for a researcher to hold more than one view simultaneously.

An overview of the different ways of seeing significance and value amongst academics and industry professionals is presented below. While the categories of description presented in the next sections represent the varying ‘ways of seeing’ discovered amongst the participants, the outcome space presented represents the interrelation between those different ways of seeing. The outcome space has been constructed to depict a holistic picture of the different ways of seeing amongst participants interviewed.

Outcome spaces have, in different projects, been found to represent historical views of a phenomenon, or to represent a hierarchy of increasing complexity and sophistication. In this study the outcome space does not reflect history or indicate a hierarchy, rather it reveals a widening awareness, a broadening of the perceptual boundary across the categories (see Table II). Amongst academic researchers, the perceptual boundaries in each category widen progressively from ‘the individual’ to ‘the institution of research’, to ‘humankind’. Amongst industry professionals they widen progressively from ‘the individual’, to ‘the enterprise’ to ‘the real world’. The term ‘humankind’ was chosen to describe the outer boundary for the academic group because participants used the term in their discourse, and it captures the essentially idealistic flavour of their thinking. The term ‘real world’ reflects the more immediate and pragmatic orientation of the industry professionals in relation to the context beyond their corporate enterprise’s commercial goals. Table II also shows the critical elements of variation across the categories, including the stable and variable elements of the foci in each category.

[Table II : Critical elements in constituting the significance and value of IT research]

Similarities and complementarities were found between the two groups of participants. Significant differences, or complementarities, appear in relation to categories two and three. Category two is unique for each group. For the academics, significance and value is constituted in category two in relation to ‘currencies’, for example the potential for publications and promotions; for industry professionals, however, commercial goals are figural in awareness. The external horizons, or perceptual boundaries, in these categories appear differently; being the ‘research community’ for academics and ‘the enterprise’ for

industry professionals. Category three, while having clear parallels across both groups, differs for both in terms of how research projects are situated in relation to the external horizons. For academics, research project design is assessed within the context of the norms of the research community; for industry professionals, the context is real world relevance. The remaining categories, one, four and five, reveal the shared ways of experiencing for which evidence was found amongst both groups. It is important to recollect, however, as shown previously, that while we have found evidence of similar ways of seeing significance and value between the two groups, the ways of constituting significance in relation to specific projects may differ within and between the groups of participants.

Graphical representations of the outcome spaces for both industry and academic groups are shown in the Appendix. While the essential elements of the first category were the same across both groups, we have found that the differences relating to the external horizons for the remaining categories, together with the differences in Category Two, necessitates separate graphical representations.

[The editor will decide whether these diagrams are best placed here or in the Appendix.]

Please note that if they are placed here, the numbering of all the figure captions and the references to them in the text will need to be edited so they run 1 to 9, from the beginning to the end of the document.]

[Figure 7 : Outcome space – Academic Researchers]

[Figure 8 : Outcome space – Industry Researchers]

Ways of constituting the significance and value of research projects

Category 1: Significance and value is constituted in relation to contribution to personal goals

In this category, significant and valuable projects are seen as those which contribute positively to the attainment of personal goals. The chief interests of IT researchers, when attributing significance or value to a project, are personal. They are fundamentally interested in the value or impact of the project on themselves or their professional role. They may be

attending to the professional interest aroused by the project (Subcategory 1a) or to the personal professional gain that may accrue from it (Subcategory 1b).

In *Subcategory 1a*, significant and valuable research projects are seen as those which arouse interest. They may ‘*like to do it*’ (A11.2b); the project may arouse their curiosity (A9.2b), ‘*this one actually interests me in the theoretical...*’ (I18.1d); or the researcher may find the research fun (I14.7c).

In *Subcategory 1b*, significant and valuable projects are seen as those which contribute positively to the researcher’s own career or research agenda.

... you would probably judge something as insignificant if it doesn’t contribute ... to your job ... in teaching or if it doesn’t advance in some way your career. (A11.3b)

... it depends on what you are trying to do as to what is significant for you ... If your aim is to write a program to sell to Queensland Rail ... you’re not interested in modelling their company to suit their accounting system ... (A8.6c)

Significant projects are seen as those that advance careers in some way, provide employment, or the opportunity for publication, or contribute to personal projects. For industry researchers, such projects may assist with solving work-related problems, with specific reference to their own work, as opposed to that of others (the latter is attended to in Category Four).

... how I decide [significance] ... is can I see how this is relevant to my work, or might be relevant to my work in the future? (I15.5a)

[Figure 2 : Awareness structure for Category 1]

Figure 2 depicts the structure of the category, which is the same for both researcher groups. The focal element, or *internal horizon*, common to both subcategories, is the ‘personal goals’ of the researcher, with varying orientations towards ‘professional interest’ or ‘professional gain’ in terms of career or research impact, associated with each subcategory. In this category, it appears that IT researchers are not seeing beyond their own benefits when considering the value of a research project. The individual, therefore, forms the perceptual boundary, or the *external horizon* of the category.

***Category 2: Significance and value is constituted in relation to research currencies
[Academics]; Significance and value is constituted in relation to commercial goals
[Industry]***

In category two, significant and valuable research projects are seen by academics as those which generate research currencies. They add value to the research community by providing funding for the employment of researchers or by enabling a research centre to continue to exist. The research currencies may be producing publications, providing grant money, enhancing group status, promoting colleagues or leading to further work. Academic researchers, when attributing significance and value this way, are concerned with how the projects generate ‘currencies’ for their research community, they are not necessarily considering their personal needs, but rather those of their research team.

I think that most people would expect a significant project ... would lead to further work, or would lead to further publications and particularly acceptance ... at conferences which were considered to be ... fairly top-level type conferences ... and would be leverage ... for further funds and further work. (A7.3a)

... at the moment it gives us money to employ researchers or to continue employing researchers whom we have been employing ... (A7.2a)

One of the recipients was very honest ... he had a project, 2 million marks or something ... and he stood up and said, “Well, I think it was very successful, this project - as a result we have three professors, they got their chairs because of it” and I think that was straight to the point, it told the truth ... (A11.4c)

For industry professionals, in this second category, significance and value are centred on the goals of the corporation in which they work. The commercial benefit returned to the corporation is their main focus. Where technology end users are mentioned, it is as clients intimately linked with the enterprise’s commercial goals. Attribution of significance and value varies within this category in relation to external operations (Subcategory 2a) or internal operations (2b). In the former, significant projects are seen as those which enable the enterprise to function successfully in the competitive environment. Competitive advantage is gained from marketable technical advances. *Each company has its own drivers and its own technical interests, depending on what their market is (I13.7a)* In the latter, significant projects are seen as those which facilitate the cost-effective running of the enterprise, ... *it saves in terms of time and dollars, so yes ... that’s an important research area in a commercial sense ... (I13.6a)*

[Figure 3 : Awareness structures for Category 2]

For academics, the focus of attention, or internal horizon in this category, is the currencies of research, with varying orientations towards supporting research and supporting education. The research community forms the perceptual boundary or external horizon of the category. For industry researchers, the focus is commercial goals, with varying orientations towards external and internal operations. In this category, industry researchers are seeing solely from the point of view of the corporation; the enterprise, therefore, forms their perceptual boundary. [See Figure 3]

Category 3: Significance and value is constituted in relation to research project design

In this category, significant and valuable IT research projects are seen as those which are appropriately designed, or are academically sound. When using this lens, the chief concerns of IT researchers have to do with the quality of the research itself. They are interested in the rigour of the project and its validity as research, with particular emphasis on methods (Subcategory 3a) and innovation (Subcategory 3b).

In *Subcategory 3a*, significant and valuable IT research projects are seen as those which are methodologically sound. These projects are seen as those which follow recognized research methodology. They are conducted by respected researchers, and intend to contribute new knowledge. They require considerable intellectual input. They have clear direction, and are valid or believable. They draw on a broad participant base or are widely applicable. They acknowledge previous research. While they may break away from funding or commercial imperatives, they follow research trends, interests or traditions.

It has to be methodologically sound, you have to apply your scientific method ... there is a whole lot of theory about ... how you proceed in finding ... new knowledge ... (A11.5a)

... the process is rigorous, and there's a quality ... (I17.8a)

I guess I'm looking for a depth of understanding of the particular field ... (I16.9a)

... I think this is probably a good example of a lot of things that I think are actually really good about research that gets done ... getting in and analysing it at a level of depth that you very rarely see inside the industry ... (I16.4c)

In *Subcategory 3b*, significance and value is constituted in relation to innovation; such projects may be seen to explore new frontiers and add to previous research. The element of innovation present in the research may be in breaking new theoretical ground, in taking a new approach to a long-standing problem or in an unexpected contribution made to the existing

knowledge base. An element of risk of failure is usually considered to accompany such endeavours. These research projects tackle difficult problems creatively.

... this would further humanity's knowledge and ability ... to go into fields ... where people haven't been before ... (A7.3c)

... It's about getting people to think out of the box, before coming back into the box ... (I17.8c)

... that kind of problem I'm more attracted to because that's one where you really don't know what you're going to find and it may fail ... I like more risky, more speculative research ... (A9.6a)

[Figure 4 : Awareness structures for Category 3]

In this category, for both groups of participants, 'the design of the research project' is the focus, or internal horizon, with the varying orientations being 'sound methodology' and 'innovation'. Academics are not seeing beyond the norms and mores of the research community when considering the value of research projects; the research community, therefore, forms their perceptual boundary. The perceptual boundary for industry researchers extends beyond the enterprise to the wider world. [See Figure 4]

Category 4: Significance and value is constituted in relation to value to technology end users.

In this category, significance or value is attributed to a project in terms of service to people. When looking through this lens, researchers see significant and valuable research projects as those which serve information technology end-users. They may be attending to the potential for the project to help people experience the advantages of technology (Subcategory 4a), or to impact positively on the whole of society (Subcategory 4b), or impact on particular subgroups of society (Subcategory 4c).

In *Subcategory 4a*, significant and valuable IT research projects are seen as those which act as enablers to end users. They may enable people to live or work better together, to use technology easily or to manage information more skilfully, thus improving on current practice. In this view, significant and valuable research adapts technology to people, reducing the need for people to adapt to technology. Through these projects IT researchers exert a constructive influence on the world.

You want to push the technology so that it serves people in the most intuitive and flexible way. (A1.2a)

IT is a service industry to the rest of the economy and the rest of the community. It needs to add some value in a lot of ways. (I16.4d)

In *Subcategory 4b*, significant and valuable IT research projects are seen as those which impact widely on the population at large. They have a breadth of applicability and serve a large body of users. Such projects may span disciplines and adopt an integrative approach. The length of time over which projects extend their influence may also be relevant.

... the idea of size comes into it ... the narrower the community the less interest you would have in it ... (A3.4c)

... world-changing ... world impact ... very few projects can actually achieve that but if it can often make steps towards that, that's important. (A6.5c)

... this is the size of the problem, you know it's just a big problem. (I14.7a)

In *Subcategory 4c*, significant and valuable IT research projects are seen as those which serve specific groups of people. They meet the needs of particular sub-groups of society. Examples of these subgroups are analysts, professionals and educators.

... its significance is that it helps analysts ... (A4.2c)

... this has a lot of application in computer robotics. (I18.3a)

... a lot of research which doesn't have obvious application has the application of informing education better ... to me the fundamental reason for academies is education ... (A10.6d)

[Figure 5 : Awareness structures for Category 4]

For both groups of participants, the focus, or internal horizon, in all these subcategories is on benefits to the end-user. They are thematising the positive results of the project for people. In this category, IT researchers are seeing the end user in the context of the benefit the research offers to humanity. Humankind, therefore, forms the perceptual boundary, or external horizon, of the category. Industry researchers are concerned for actual clients as technology end users, in the context of the wider world outside the enterprise. Industry researchers' external horizon for this category is, therefore, the real world. [See Figure 5]

Category 5: Significance and value is constituted in relation to solving real-world problems.

In this category, significant and valuable IT research projects are seen by researchers as those which address real-world problems. Their interests, when using this conception, are directed towards finding solutions to problems, with different emphases on commonly accepted problems (Subcategory 5a), contemporary problems (Subcategory 5b) and problems which have practical application (Subcategory 5c).

In *Subcategory 5a*, significant and valuable IT research projects are seen as those which address real-world problems that have been identified by a number of people. The problems dealt with are known, accepted, identified and long-standing.

... the reason why ... projects within the research area are significant is because all the projects ... address identified and immediate problems. (A6.3a)

... it certainly is good technology ... it does solve a problem. (I16.5d)

In *Subcategory 5b*, significant and valuable IT research projects are seen as those which find timely solutions. These projects are up-to-date. They are completed before the problem addressed becomes a non-issue. The problems they concentrate on are of immediate interest. They follow trends with respect to academic interest and with respect to end-users' needs and anticipated demands.

... it needs to be timely. There needs to be ... a bit of foresight, a bit of ... prediction as to where the demands or where the industry is going to be in a few years' time ... you've ... got to solve problems that you believe are going to be problems by the time they're solved. (A6.5a)

... its significance is that ... it can be applied ... immediately ... (A5.5c)

... and probably in five years' time there will be something else they think is valuable ... knowledge management is just the big all consuming thing at the moment ... (I15.6b)

In *Subcategory 5c*, significant and valuable IT research projects are seen as those which result in an application in a real-world context. Even the significance of 'pure research' is seen in terms of its future usefulness for problem solving. According to this view, solutions found in research must eventually be implemented in order for that research to be significant.

... it has to have a real world application ... everything has to be for something ... (A8.3d)

... information technology is an engineering discipline ... we are in the business of creating applications, of using the knowledge to produce useful gadgets, artefacts, programs, whatever ... (A11.6b)

... I suppose the way I am valuing these is I am looking at the more direct applications ... (I 18.3b)

[Figure 6 : Awareness structures for Category 5]

When considering the value of a research project, using this lens, researchers are focussing on 'solving real-world problems'. Each of the subcategories is associated with varying orientations towards 'commonly accepted problems', 'timely solutions' and 'applied outcomes'. Academic researchers are also looking towards the influence of that research on humanity. Humankind, therefore, forms the perceptual boundary, or external horizon, for this

category. Industry researchers are interested in practical solutions to real problems, in the context of the wider world outside the enterprise. Industry researchers' external horizon for this category is, therefore, the real world. [See Figure 6]

Discussion

Gibbons, et al. (1994) have suggested that a new (Mode 2) way of knowledge production is developing. Mode 2 knowledge production involves the short-term formation of teams of specialists, with a view to finding a solution to a specific problem. This trend towards transdisciplinarity, heterogeneity and transience places demands on researchers in terms of understanding of self and others, communication and consensus. The outcomes of our investigation begin to offer a means by which Mode 2 researchers in the IT discipline can understand how research is valued in the IT research community. This is significant because the ability to understand each other and work together is integral to Mode 2 knowledge development. Furthermore, Mode 2 knowledge development seems to be a key feature of teams engaged in ground-breaking research: "it does appear that ... (Mode 2 trends) ... occur most frequently in those areas which currently define the frontier and among those who are regarded as leaders in their various fields" (Gibbons, et al., 1994, p. 1).

This project has begun to illuminate what have for long been hidden agendas and unarticulated views about what constitutes valuable and significant IT research across the IT discipline. Such an illumination is not intended to force agreement. Rather, it will underpin, and make possible, the beginning of a process of critical reflection. The outcomes represent a preliminary framework within which researchers can understand their differences and seek avenues for research convergence and cooperation. The outcomes represent different ways of seeing the significance and value of IT research from a broad perspective, without directly associating them with specific IT disciplines or sub-disciplines. The intention is not to classify specific researchers or groups of researchers, but rather to identify different ways of seeing that may change with the context in which they work. The development of such a framework is intended to allow researchers from the various groups to interact with the framework freely.

Understanding this aspect of IT researchers' collective consciousness provides insights into some possible motivations and barriers in the formation of strategic intra-disciplinary partnerships. The results of this investigation show that the significance and value of specific research projects may be interpreted very differently by researchers in the same collegial environment. This suggests that learning at the collective level may be facilitated, or hindered,

by particular understandings of the research endeavour that are constituted within the research community. If we assume that commitment to, or willingness to pursue, a research project is predicated, at least in part, on a valuing of that project, then the results suggest that such valuing may or may not be interpreted in the same way between potential research partners. Concomitantly, the adoption of different perceptual boundaries or different foci between potential intra-disciplinary collaborators, in relation to the question of significance, may hinder prospective collaborations. It is possible that intra-disciplinary research partnerships and collaboration may be challenging where participants do not appreciate each other's ways of seeing, or do not share the same views.

Challenges associated with different ways of seeing may also arise in relation to establishing partnerships between academic and industry researchers. This may occur, for example, where some researchers are focussed on the theoretical or long term interests of a research project, and others are focussed on meeting immediate commercial needs. The following quotes illustrate this particular tension:

... we get an inferior product coming out ... the better things get squashed for a while ... I don't like necessarily the commercial influence in research ... (A7.10a)

... yeah, that's nice emerging technology but unless it's really close to what we are doing, somebody can try and play with it in their own time ... (I14.8a)

The evidence demonstrates, not that the researchers are incompatible, but that their drivers are different. While they have many ways of seeing in common, the contexts, or cultures within which the two groups operate are not shared, they are not part of each others' lived experience.

While it is interesting to note key differences between the two groups, of considerable importance are the similar ways of constituting significance and value that appear amongst the groups. It appears, therefore, that building or strengthening learning communities for researchers could involve raising awareness of the similar and different ways of seeing amongst neophytes, including research students, as well as more experienced researchers. Learning or developmental strategies based on this research would attend to revealing the different possible points of focus, and widening perceptual boundaries, for both of these groups, as well as encouraging reflection and discussions among different members of the community. Such awareness-raising opportunities would have the potential to strengthen the collective consciousness, and should encourage reflection on the possible variation and

implications of that variation. If research partnerships are more likely amongst colleagues who have similar ways of seeing, then self understanding and appreciation of the viewpoints of other groups' members might assist the identification of natural research partners, as well as alerting potential partners to complementary ways of thinking.

Conclusion

Learning, for researchers, involves coming to continually new ways of seeing their research, its objects and territories. This investigation represents an early step in coming to understand the learning community of IT researchers. We have developed a framework depicting one facet of the collective consciousness of IT research, a picture of the different ways in which significance and value is interpreted by IT researchers. This framework will enable self-reflection and awareness within the IT community, and may be used for comparison with the understandings of other stakeholder groups such as interdisciplinary partners. We can conclude from the project thus far that investigating the collective consciousness of IT and other research communities may provide useful insights into the character of those communities. Further work will investigate IT researchers' views of their research object and territory in order to understand other, and wider, dimensions of the collective consciousness of IT research.

References

- BAILLIE, C., J. EMANUELLSON & F. MARTON (2001) Building knowledge about the interface, **Composites Part A: Applied Science and Manufacturing**, 32, Issues 3-4, pp. 305-312.
- BOWDEN J. & F. MARTON (1998) **The university of learning: Beyond quality and competence in higher education** (London, Kogan Page).
- BOWDEN, J. & E. WALSH (Eds) (2000) **Phenomenography** (Melbourne, RMIT Press).
- BREW, A. (2001) Conceptions of research: a phenomenographic study, **Studies in Higher Education**, 26(3), pp. 271-285.
- BREW, A. (1998) Understanding research: exploring different conceptions, in: J. HIGGS & R. CART (Eds) **Writing qualitative research** (Sydney, Hampton Press).
- BRUCE, C. (1994) Research students' early experiences of the dissertation literature review, **Studies in Higher Education**, 19(2), pp. 217-30.
- BRUCE, C. (2001) Interpreting the scope of their literature reviews: significant differences in research students' concerns, **New Library World**, 102(1163/1164), pp. 158-165.

- BRUCE, C. & B. PHAM (2001) Investigating ways of seeing IT research: a tool for facilitating effective research partnerships?, in: **Learning Partnerships, Proceedings of the 24th International HERDSA Conference** (Newcastle, HERDSA).
- BRUCE, C., B. PHAM & I. STOODLEY (2002) **The collective consciousness of information technology research. Ways of seeing information technology research: Its objects and territories.** (Faculty of Information Technology Technical Reports, Queensland University of Technology) May be retrieved from <http://sky.fit.qut.edu.au/~bruce/pub/>.
- GIBBONS, M., C. LIMOGES, H. NOWOTNY, S. SCHWARTZMAN, P. SCOTT & M. TROW (1994) **New production of knowledge: dynamics of science and research in contemporary societies** (London, Sage)
- HARMAN, G. (2001) Industry-research partnerships in Australia: extent, benefits and risks, **Higher Education Research and Development**, 20(3), pp. 245-264.
- JACOB, M. & T. HELLSTROM (Eds) (2000) **The future of knowledge production in the academy** (Buckingham, England, Society for Research into Higher Education and Open University Press).
- KEMP, D.A. (1999) **Knowledge and innovation: A policy statement on research and research training** (Canberra: Commonwealth of Australia, Dept of Education, Training and Youth Affairs. DETYA No 6425).
- KILEY, M. (2000) **Students' conceptions of research** Website. http://www.canberra.edu.au/celts/scor/conf_pres.html. [Accessed 25 September 2002].
- MARTON, F. (2000) The structure of awareness, in: J. BOWDEN & E. WALSH (Eds) **Phenomenography**, pp. 102-116 (Melbourne, RMIT University Press).
- MARTON, F. & S. BOOTH (1997) **Learning and awareness** (Mahwah, New Jersey, Lawrence Erlbaum).
- PHAM, B. (2000) Research at regional universities in Australia: visions and realization, **Higher Education Management**, 12(2), pp. 117-130.
- SARA, V. (1998) **Information technology: Sink or swim** (Australian Academy of Technological Sciences and Engineering. Australian Research Council. Canberra Aust: Ausinfo).

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Appendix

[Figure 7 : Outcome space – Academic Researchers]

[Figure 8 : Outcome space – Industry Researchers]

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