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Abstract
The world has become an open or 'flat' place. Information Systems (IS) students who graduate may wonder where their qualifications will take them in this world. How could they use it to make the most of it? And for those who want to venture into a higher degree, what can they expect in this new venture? I believe with Madni that "[t]he time has come for us to begin for (sic) exploiting the 'flatness' of this world with open minds and a commitment to transdisciplinary research and education, the next frontier in the intellectual and societal growth of human kind" (2007:10). This paper explores transdisciplinarity in IS by means of a literature review in order to come to a better understanding of the concept and I hope that it could make a small contribution towards the academic debate.

Keywords: Transdisciplinarity, interdisciplinarity, multidisciplinarity, intradisciplinarity, Information Systems

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Transdisciplinarity in IS: The next frontier in computing disciplines

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The world has become an open or 'flat' place. Information Systems (IS) students who graduate may wonder where their qualifications will take them in this world. How could they use it to make the most of it? And for those who want to venture into a higher degree, what can they expect in this new venture? I believe with Madni that "[t]he time has come for us to begin for (sic) exploiting the 'flatness' of this world with open minds and a commitment to transdisciplinary research and education, the next frontier in the intellectual and societal growth of human kind" (2007:10). This paper explores transdisciplinarity in IS by means of a literature review in order to come to a better understanding of the concept and I hope that it could make a small contribution towards the academic debate.

Information Systems has generally been regarded as an interdisciplinary field (De Albuquerque and Simon, 2007:1461), but Galliers (2003:338) suggested already in 2003 that it should become more transdisciplinary in the future in order to widen its scope. He believes that there is "strength in diversity and pluralism" and that a reductionist agenda for IS is dangerous and self-defeating because "[c]losed systems exhibit entropy; open systems do not" (Galliers, 2003:346-347).

In order to understand what interdisciplinarity and transdisciplinarity mean, one has to start with at third concept, multidisciplinarity, which is the collaboration of scholars from various disciplines to investigate different perspectives on a specific problem or issue. Interdisciplinarity tries to integrate these perspectives into a coherent whole, while transdisciplinarity goes even further by applying the new insights and knowledge to the benefit of organisations and society.

The problem with multidisciplinary projects is that they often "mechanistically pool the expertise of participant disciplines" (Kyriakidou and Venters, 2007:840). There is little understanding amongst the collaborators of the goals and preconceptions of the other team members, which may eventually lead to a breakdown in communication. Strong leadership and a common goal, as well as informedness about all participants' aims make a huge

difference to bridge the differences and misunderstandings. The idea of bridging the gaps in knowledge in knowledge fields brings us to inter- and transdisciplinary work.

The goal of an interdisciplinary science, like IS, is to integrate and synthesise borrowed ideas into its core, maintaining a coherent and stable theory (Hassan and Will, 2006:174). This implies that the focus is primarily on rigour, while a transdisciplinary field aims in the first place for relevance. This does not mean, however, that relevance is unimportant for interdisciplinarity or that transdisciplinary science should not be rigorous. Since the core of IS has always been inclusive, the discipline should be able to easily transform itself into a transdisciplinary field using a never-ending cycle of borrowing and consolidation to ensure both relevance and rigour (Teo and Srivastava, 2007:518, 528).

The differentiation between interdisciplinarity and transdisciplinarity is, however, not that clear in literature. Vashist et al. (2011) accept the notion that the creation of a new discipline is typical of transdisciplinarity, while De Albuquerque and Simon (2007:1460) believe it is typical of interdisciplinarity. Most authors agree that boundary spanning is typical of transdisciplinarity and, therefore, it makes more sense to regard the creation of new disciplines as interdisciplinarity in order to keep the transdisciplinarity category open for research activities that transcend disciplinary borders. Both concepts share the idea of an integration of concepts and approaches from several disciplines in order to explore and solve problems that cannot be dealt with in a singular discipline. When interdisciplinary work leads to a new discipline (such as IS) the methods and theories may become standardised, but this new discipline may again be combined with other subjects in a cyclical way to create new interdisciplinary or transdisciplinary research (e.g. e-commerce).

The criteria of novelty and importance seem to differentiate transdisciplinarity from interdisciplinarity (Weber, 2012). This is where research in IS can make a huge contribution since a strong focus on problem solving is typical of both IS and transdisciplinary research (De Albuquerque and Simon, 2007:1460). Critical theory and action research are examples of IS paradigms and research methodologies that focus on improving organisations and society.

The practical focus of transdisciplinary IS is very clear in several publications. Elliot (2011) encourages it in order to promote environmental sustainability. Not only should IT try to minimise its own impact on the environment but it should also be used to address the carbon

footprint of other industries (Elliot, 2011: 200). This necessitates the collaboration of different disciplines to approach a common problem and to find solutions which may change business practices in the process (Elliot, 2011: 204). The impact-orientation of transdisciplinary work may especially be a contribution from IS side – information systems are today pervasive in all business endeavours and they are used to change processes and behaviour to complement insights from other disciplines and to enhance efficiency. In the academic world, our community engagement is one attempt to use our knowledge and skills in a practical way. This enables academic staff to reach out to the community, while they also enrich their tuition and research at the same time.

The idea of novelty is also very important in transdisciplinarity with regard to its theoretical contributions. Weber's (2012) suggested framework and criteria (including novelty and importance) can be used to evaluate and develop new innovative theories in the IS discipline. The static borders of a settled discipline often need to be deconstructed in order to see and solve new problems. Deconstruction is the idea that all phenomena are deeply embedded in cultural environments and that these layers must be uncovered in order to properly understand the core of the issues (De Albuquerque and Simon, 2007:1460). When a discipline becomes established it becomes a "self-bounded entity", and its scope is determined by the specialities of its researchers, journal editors' and reviewers' agendas and the needs of universities and colleges offering the subject (Hovorka, 2010: 6). The individuality of a discipline is not a given, but something that evolves and changes as the academic society and the wider society changes (Teo and Srivastava, 2007:525). Deconstruction is typical of the postmodern era of our times, while the related call for a pluralistic approach to solve complex problems is typical of the related concept of postpositivism. Hirschheim (1985) already pleaded in 1985 for methodological pluralism in IS theory which transcends the limitations of the scientific method (positivism).

The main attributes of multi-, inter- and transdisciplinarity are summarised, and compared to intradisciplinarity, in Table 1 below.

Table 1. A summary of the main attributes of intra-, multi-, inter- and transdisciplinarity (cf. Vashist et al., 2011; Elliot, 2011:A1; Madni, 2007:2; Galliers, 2003:347; De Albuquerque and Simon, 2007:1460; Hassan and Will, 2006:172).

Attribute	Intra-disciplinarity	Multi-/Pluri-/Cross-disciplinarity	Inter-disciplinarity	Trans-disciplinarity
Collaborative nature	Collaboration of researchers within one discipline	Collaboration of researchers from various disciplines	Collaboration of researchers from various disciplines, integrating various insights; synthesis	Collaboration of researchers from various disciplines, integrating various insights
Goal	To optimise quality and speed of research output	To show different perspectives on a phenomenon	To understand a complex phenomenon which cannot be solved within a single discipline	To solve problems; to change behaviour significantly
Disciplinary nature	Discipline static and looking inwardly	Discipline unchanged but interacting with other disciplines	Discipline enriched New discipline	Across disciplines, beyond academic disciplines, looking outwardly
Theoretical nature	Theoretical exercise	Theoretical exercise	Theoretical exercise	Theoretical exercise leading to practical solutions
Source/cause	Stimulated by complex theoretical challenges	Stimulated by complex theoretical challenges	Stimulated by complex theoretical challenges	Stimulated by complex practical problems
Methods	Using methods from one discipline	Using methods from different disciplines	Connecting approaches in order to find successful methods	Holistic approach to unify knowledge inputs
Result	Better solutions for disciplinary challenges	Better understanding of contributing perspectives regarding complex problems	Improved understanding and sensitivity for complex problems	Better solutions for complex problems
Scope	Organisation (narrow)	Organisation/ Society	Organisation/ Society	Society (broad)
Properties	Definite	Definite	Evolving to definite	Evolving

Let us now explore the concept of transdisciplinarity in IS theory and practice. Information systems are pervasive nowadays in almost all aspects of life. It is used, for example, to reduce the negative effect of industry on the environment, and, of course, also to become more efficient in itself. This calls for collaboration across disciplines. Similar to the use of IS to facilitate green IT in other industries, is the use of IS to facilitate transdisciplinary research in other disciplines. Larsen, Lee, Li and Bong (2010) developed software that links related literature using divergent and inconsistent terminology which makes it difficult for humans to sense the connectedness with their own work. They trust that the use of this technology will enable behavioural scientists to build upon another's work. Since the purpose of this software is to enable integration and a holistic approach, it may be regarded as transdisciplinary in its own right. A shared ontology that overcomes mismatches in terms and concepts is another example of "transdisciplinary intervention" (Madni, 2007:7).

A more theoretical example of transdisciplinary work in IS is the creation and use of frameworks. The development of frameworks is one way of integrating perspectives from different disciplines centred around one complex problem (cf. Elliot, 2011:220). Frameworks are useful to mould divergent facets into a new, coherent and holistic paradigm/construct. This may explain the popularity of frameworks in IS theory.

The Special Interest Group for Philosophy of the AIS (SIGPhil) focuses on IS theory and philosophy. This group of researchers is reflecting on ways to enrich the IS discipline using philosophy, which is a humanities field, to reflect on the state of the art in IS. Humanities-enriched IS is one attempt to transcend the traditional boundaries of the IS discipline, i.e. the exploration of the application of IT in business and organisation. In addition to being a central part of the business sciences, IS may also become part of this network of disciplines in order to contribute to them and to borrow from them (cf. Hovorka, 2010:11-13). The linking of scientific disciplines with the humanities is necessary to address social issues in these disciplines (Madni, 2007:9). De Albuquerque and Simon (2007:1459) see the relationship between IS and the human sciences as a multidimensional field, the study of which needs the articulation of a plurality of research approaches and theories. Philosophical rigour (creative and differentiating thinking) is as important as methodological rigour (replicability) since it is necessary to reflect in depth about new complex phenomena in order

to understand them properly (Teo and Srivastava, 2007:528). Copying ideas from the humanities as reference disciplines may stimulate the innovative thoughts needed.

The integrative and holistic characteristics of transdisciplinarity in IS are important to ensure the attainment of the ideal graduate attributes (or 'graduateness') of computing students. Due to the wide and divergent scope of the IS subject there is a real danger that computing departments will deliver "multidisciplinary illiterates" or generalists rather than specialists (Hassan, 2008:1). A transdisciplinary education agenda should identify complex problems and include these in curricula. It should research solutions to bridge the knowledge gaps (Madni, 2007:8). The internet should be explored and used to facilitate transdisciplinary research and distance learning. This will infuse the transdisciplinary thinking skills that are needed to develop humankind in the new era (Madni, 2007:10).

IS lecturers have a responsibility to equip their students with the necessary theoretical and practical skills to live up to the challenges of this new age. Therefore, they also have to continue to cultivate their own 'academicity' and to enhance their programmes for future cohorts of students. According to Hassan (2008:3-5), IS academics should focus not only on the discovery of unique IS concepts, but also on the integration of ideas with other disciplines and practices to contribute and to clarify boundaries. Lecturers must be knowledgeable themselves, and they should, of course, convey their ideas to their students, but in addition they should also do research about their educative practices in order to improve the curricula continuously. An advisory board is helpful to ensure the relevance of our teaching and research. Talking to colleagues from information systems businesses and other academic institutes may help us to avoid a mismatch between IS curricula and industry expectations, and to integrate managerial and technical aspects of IS (cf. Hassan, 2008:1). Departments should explore ways to widen their scope and to offer a wider plurality of courses, e.g. by developing new programmes in IT service management. We often teach our students how to program but not how to be managers, which they often quickly become once employed. National and international accreditation of our programmes is other mechanisms to ensure quality and relevance. Hassan (2008:4) pleads for a certification programme for IS in order to raise the profile of IS as a profession and to overcome the lack of application. The practice of theory and concepts must be part and parcel of the IS curriculum. Signature modules may be used to round off students knowledge by gaining an understanding of cultural issues in IS and ethical academic behaviour. A capstone module can bring together all the skills and

knowledge of our students in a transdisciplinary way to transcend the borders of the subdisciplines by solving a complex problem.

A transdisciplinary approach may be the solution that academic IS departments need in order to survive in a world of open education where a tsunami of free, online courses poses a threat to traditional teaching models.

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