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Proposing a fifth generation of knowledge management for development: investigating convergence between knowledge management for development and transdisciplinary research

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This paper describes the process of encounter between the field of knowledge management for development (KM4D) and transdisciplinary research which have led to the convergence between the two fields in terms of a focus on real world problems in a complex world; multiple actors; processes and methodologies; and knowledge integration and co-creation. The development of both fields is traced chronologically. The convergence is only between fifth generation KM4D and transdisciplinary research and does not relate to previous generations of KM4D. Despite this increasing convergence between the two fields, KM4D can learn from transdisciplinary approaches in terms of its theoretical underpinning; contribution of new knowledge; an emphasis on the wider systemic issues of knowledge; methodological approaches; and knowledge integration and co-creation.

Keywords: knowledge management for development; transdisciplinary research; multi-stakeholder process; convergence; complexity; emergence, knowledge integration, knowledge co-creation

Introduction

This paper is the first paper in the September 2013 Special Issue of the *Knowledge Management for Development Journal* on the subject of 'Breaking the boundaries to knowledge integration: society meets science within knowledge management for development'. The Special Issue aims to highlight the links between the developing fields of knowledge management for development (KM4D) and transdisciplinary research. The objective of this paper, and of the Special Issue of which it is part, is to investigate the links between the two fields in order to stimulate KM4D to learn from the approaches of transdisciplinary research. Hopefully, and at the same time, we will identify ways in which transdisciplinary research can benefit from the perspectives and body of knowledge which is KM4D.

Within the KM4Dev community of practice[1] and the wider field of KM4D[2], there has been a growing emphasis on the need to break down the boundaries between research, practice and

policy because these boundaries hamper knowledge development, knowledge management and sharing of knowledge (Ho, Stremmelaar and Cummings, 2012). One way of overcoming these hampering factors is by engaging in the systematic process of knowledge integration:

> *By integrating various forms of (new) knowledge - academic, practitioner, educational and cultural expressions of knowledge - new insights can be created and strategies formulated that contribute to the development of new policies and practices for the development sector*. (Ho, 2011: 13)

Independent of the terminology used, a study of sectors including agriculture, health, and science, technology and innovation (STI) points to an apparent move of KM strategies towards knowledge co-creation as multi-level, multi-actor and multi-method approaches to unstructured problems in which boundary work and boundary spanning figure centrally (Ho, 2011).

The concepts of knowledge integration and knowledge co-creation fit within the tradition of transdisciplinary research which is distinct from mono-, multi- and interdisciplinary research in that transdisciplinary research transgresses the boundaries of scientific disciplines by including experiential knowledge of societal actors in the research and problem solving process. Transdisciplinary research approaches are, however, often not recognised as such because they go by a different name and are embedded in local scientific, cultural and political practices that differ by country. Examples of transdisciplinary research approaches are: integrated research studies, constructive technology assessment, interactive learning and action, and participatory action research. These approaches all share some essential features, including focus on real world problems, involvement of multiple stakeholders, integration of different forms of knowledge, and crossing boundaries between disciplines and between science and society. These characteristics are also increasingly to be found in the field of KM4D.

As we mentioned above, the purpose of this paper is to look at the fields of KM4Dev and transdisciplinary research with a view to considering how they can learn from each other, using examples from the articles published in this Special issue. First, we describe the interaction between members of KM4Dev and transdisciplinary researchers which led to the development of this Special Issue. Next, we provide an overview of transdisciplinary research, its main characteristics and how it has evolved over the years since the 1970s. Third, we introduce the field of KM4D, attempting to give an overview of its current state-of-the-art and to provide an analysis based on understanding of different generations of KM4D. Fourth, we consider convergence and divergence between KM4D and transdisciplinary research. In the last section, we consider how KM4D can benefit from transdisciplinary research and vice versa. We start, however, with the background to this Special Issue.

A personal journey: a bridge over troubled waters

Two of the authors of this paper are actively involved in the field of KM4D (Sarah Cummings and Wenny Ho) while the other two (Barbara Regeer and Marjolein Zweekhorst) come from the tradition of transdisciplinary research. For the two KM4D authors, their own recognition of the links between KM4D and transdisciplinary research has some characteristics of a personal journey in which particular events and colleagues played an important role, and which took place over a number of years. Below we describe this journey in some detail because it explains how this issue came about. Although we are describing something of a personal journey, we think it is also very likely that others working in KM4D are also increasing encountering others working in a transdisciplinary tradition and are being influenced by them and their work, and vice versa. This seems to be borne out by a recent conversation (4-11 November 2013) on the KM4Dev discussion list[3] on transboundary learning and innovation for development.[4]

From our perspective, the first step in the process of increasing interaction and synergy between transdisciplinary research and KM4D started when the transdisciplinary researcher and activist, Valerie Brown, came into contact with members of KM4D. Somewhere, probably around 7 years ago, Mike Powell met Valerie Brown at a conference. At that time, Mike Powell was starting up the IKM Emergent Research Programme[5] and he recognised that Valerie's understanding and practice of multiple knowledges in the resolution of complex problems at community level (Brown 2008) was a conceptual development which could make an important contribution to the IKM Emergent's practitioner-based research programme and to the KM4D field in general. Intrinsic to multiple knowledges is the recognition that different knowledges (individual, community, specialist, organisational, holistic) have different priorities and perspectives and that they are all required in the resolution of complex, socially embedded problems. Since this chance meeting between Valerie Brown and Mike Powell, and reflecting the work of IKM Emergent in which Valerie was also involved, multiple knowledges has become accepted as something of a central tenet of more recent understandings of KM4D as will be described below. Prior to this general acceptance of the framework of multiple knowledges, the KM4D field was struggling with an implicit understanding of the importance of local and community knowledge but was missing a conceptual framework to which it was central. In this increasing interaction between Mike Powell, IKM Emergent and KM4D, Valerie Brown became an active member of the KM4Dev community and a writer of some key texts for KM4D (2008, 2009 and again in this Special Issue) in addition to producing a host of other articles and books (see, for example, 2011, 2013, 2014).

Starting at roughly the same time in 2007, Sarah Cummings and Wenny Ho, with Josine Stremmelaar, undertook a number of activities over a period of six years (2007-2012) which aimed to break down the barriers between the knowledges of practitioners, researchers and policymakers in the development sector, based on an understanding, which was fairly common in the development sector at that time and which is still extant, that epistemological differences between these key stakeholders represent a considerable barrier to both knowledge sharing and

to effective development.[6] This collaborative work which involved a number of workshops to scope this area, including a *huddle* at the KM4Dev meeting in Brussels in 2009[7], was eventually followed by an in-depth review of knowledge integration, undertaken by Wenny Ho (2011). In this review, it became clear that there was an already existing area of research that was explicitly focused on knowledge integration and co-creation from which KM4D would be able to learn. In the seminar which followed the review in January 2012, Wenny Ho and Sarah Cummings met Joske Bunders of the Athena Institute for Research on Innovation and Communication in Health and Life Sciences, the VU University Amsterdam, for the first time. As they grew more aware of the Athena Institute's work, they saw an increasing affinity between transdisciplinary research, including the emphasis on knowledge processes and co-creation, and KM4D. In fact, they considered that the Athena Institute's understanding of knowledge processes and knowledge co-creation with a variety of different stakeholders seemed to be something from which KM4D could learn. This awareness sowed the seeds for this Special Issue which represents collaboration between transdisciplinary researchers at the Athena Institute and KM4D.

In the 'Call for papers' for this Special Issue, broadcast earlier this year, the team of Guest Editors was hoping to identify KM4D approaches which were already being framed with a transdisciplinary lens and, at the same time, aimed to stimulate trandisciplinary researchers to employ a KM4D lens to their research. In this way, the Special Issue was an opportunity to look to what extent such an approach was possible and whether those working in either field were able to look at their work through the lens of the other.

The history of knowledge management for development[8]

KM4D is currently an active field of practice with, at its core, KM4Dev, a vibrant network of 3000+ participants and, including many other things, its own journal in which this Special Issue is being published. The field and its associated network are characterized by recognition of the importance of knowledge to development and also a desire to change how development is being done; leading to claims that it represents a new Enlightenment (Ferreira 2009). Indeed, KM4D can provide understanding, experience and lessons that can contribute to new perspectives on global societies as knowledge societies rather than just having relevance for development per se (Powell and Cummings Forthcoming).

The field of KM4D is generally recognized as having started in the late 1990s when the World Bank, under the leadership of Steve Denning, began to position itself as the 'knowledge bank'. Roughly coinciding with this, the World Bank published the ground-breaking World Development Report, *Knowledge for Development* (1998-99) which emphasized the link between development and knowledge, arguing that poverty is the same as lack of knowledge:

> *Knowledge is like light. Weightless and intangible, it can easily travel the world,*

> *enlightening the lives of people everywhere. Yet billions of people still live in the darkness of poverty.*

In the late 1990s 'mainstream' KM, namely approaches to KM in the business sector, entered the development sector. Since this time, the field of KM4D has undergone considerable change, influenced by the experience of implementing KM but also by influences from the both inside and outside the development sector. Many different authors have divided different approaches to KM into generations with recognition of up to four generations. Ferguson and Cummings (2007) identified four generations of KM in development that very much reflect changes in the field of mainstream KM (see Table 1 for a comparison between mainstream KM and KM for development).

The first generation is ICT based with an emphasis on knowledge as an object. It involves focus on the use of ICTs, knowledge databases, portals, and clearinghouses. The second generation is organisation-based and is characterised by having knowledge processes embedded in organisational processes, the rolling out of organisational KM strategies and the establishment of organisational communities of practice. Third generation KM4D is characterised by knowledge sharing and involves: KM methods and techniques (such as the After Action Review, and the peer assist); case studies and best practices; and more emphasis on tacit knowledge. The fourth generation comprises practice based, people centric approaches to KM and involves the establishment of inter-organizational communities of practice; and the increased role of social media. Kindly note that the use of the term, best practices, in inverted commas aims to reflect recognition of the fact that 'best practices' are not recognised by some commentators.

At the time that the 2008 review was published, most reference was made to approaches which originated in the KM mainstream. However, as we will explain in more detail below, this perspective is changing as KM4D is going its own way. In its fifth generation, KM4D is moving beyond mainstream KM and appears to be have been influenced, either explicitly or not, by the developing field of transdisciplinary research.

History of transdisciplinary research[9]

In 1970, the Organisation for Economic Cooperation and Development (OECD) organised an international seminar in Paris on 'Interdisciplinarity in Universities'. The seminar was a response to the growing awareness that the monodisciplinary nature of scientific education and research was not adequate for the changing needs of science and society. There was a need for holistic knowledge about real life and for the integration of disciplinary knowledge resulting from scientific analysis. Apostel and colleagues (Apostel, Berger, Briggs, & Michaud 1972: 10) argued that what was needed was more than pluridisciplinary research (now generally referred to as multidisciplinary) in which different disciplines work side by side on aspects of the same

Table 1: Different views on generations of knowledge management
(updated and adapted from Ferguson, Cummings and Mchombu 2008)[10]

	Generations of KM			
	1st generation ICT based	**2nd generation Organisation based**	**3rd generation Knowledge sharing based**	**4th generation Practice based**
Characteristics of KM4D *(amended from Ferguson and Cummings 2008)*				
Key perspective	Knowledge as a commodity	Knowledge as an asset within organisations	Knowledge sharing between organisations	Knowledge processes embedded in organizational processes
Methods and tools	ICTs; databases portals; and clearinghouses	KM audits; KM scans; and both explicit and tacit knowledge	Peer assist; Case studies; 'best practices'; and inter-organizational communities of practice	Increased role of social media; people-centric; and practice-based
Characteristics of mainstream KM (*based on Huysman 2007; Laszlo and Laszlo 2003; Snowden 2002; Koenig 2005)*				
Epistemology	Epistemic Objectivism[1]	Human and cultural dimensions of knowledge[4]	Social embeddedness of knowledge[1]	Situated, contextual knowledge[4]
Key concepts	Knowledge as a commodity	The learning organization[4]	Builds on complex-adaptive systems theory[3]	Embedded leadership[1] Distributed networks[1] The 'knowledge of evolution'[2]
Role of IT	IT- determinism[1] IT-centric[4] Internet and intranets[4]	IT central role	IT dirty word[1]	Supportive role of IT[1]
Types of knowledge	Standards and benchmarks[2] Codified intellectual capital[4]	Tacit and explicit knowledge[3]	Context, narrative, stories[3]	Knowledge related to corporate citizenship and its impact on global development[2]
Role of KM	Structuring information for decision support[3] Computerization of business processes[3] Codification of intellectual capital[4]	Knowledge creation to satisfy organizational needs[2] Organizational learning and value creation[2]	Content management[3] Content management and taxonomies[4]	The importance of extra-organizational sources[4]
KM process	Distribution of organizational knowledge, through technology[2]	Tacit/explicit knowledge conversion[3] Intra-organizational communities of practice[4]	Inter-organisational communities of practice[1] Immersion in practice[1]	Participatory forms of engaging in meaning creation[2] Inter- organizational communities of practice[4]

issue. Instead, methods, concepts and axioms of a group of related disciplines should be integrated and combined in interdisciplinary research.

A number of participants in the seminar, including Professor Jean Piaget and Andre Lichnerowicz, went further and argued that the development and maturation of interdisciplinary science would eventually lead to one general scientific theory of systems and structures. They saw the convergence of all disciplinary knowledge to one united body of knowledge as the end result of the interdisciplinary approach. This higher stage with a shared basis and terminology for all sciences was referred to as transdisciplinarity (Apostel et al. 1972: 284). In Box 1, taken from the seminar report, a summary of the different gradations in the integration of disciplines is provided.

Box 1: Transdisciplinarity as a unity of knowledge (Apostel et al. 1972: 106)

Pluridisciplinarity: Juxtaposition of disciplines

Interdisciplinarity: Integration of concepts, methods and axioms of several disciplines

Transdisciplinarity: Total integration of concepts, methods and axioms

In subsequent years, the 'unity of knowledge' perspective on transdisciplinarity was further developed by other people such as Nicolescu (2002: 44) who stated that:

> *…as the prefix "trans" indicates, transdisciplinarity concerns that which is at once between the disciplines, across the different disciplines, and beyond all disciplines. Its goal is the understanding of the present world, of which one of the imperatives is the unity of knowledge.*

A second perspective on transdisciplinarity also originated in this seminar, but only became predominant some years later. In this perspective, transdisciplinarity is not only about the internal dynamics of science moving towards an overall framework, namely towards a unity within science, but it was also related to the external aim of science. Jantch argued during the 1970 seminar that the world is constantly changing and that restructuring the overall system of society, science and nature is necessary in order to safeguard the survival of mankind (Apostel et al. 1972). This second perspective on transdisciplinarity assumes a far-reaching intertwining of science and society, which in more recent the years has been elaborated upon under the headings of social-ecological transformations (Becker et al. 1997), the triple-helix of university-industry-government (Leydesdorff & Etzkowitz, 1996), mode-2 knowledge production (Gibbons et al. 1994, Nowotny et al. 2001), sustainability science (Clark and Dickson, 2003), co-production of science and society (Jasanoff, 2004), and integration and implementation sciences (Bammer 2013).

The intricate relationship between science and society is reflected in a second definition of

transdisciplinarity which was drafted thirty years after the OECD seminar in Paris, when eight hundred people met in Zürich for the conference on 'Transdisciplinarity: Joint problem-solving among Science, Technology and Society'. The discussions were not about the unity of knowledge, but about solving persistent societal problems. The definition that was formulated during the conference was thus focused on devising solutions for real world problems in collaboration between multiple stakeholders from different parts of society, including academia (see Box 2).

Box 2: Transdisciplinarity as societal problem solving

Transdisciplinarity is 'a new form of learning and problem-solving involving co-operation between different parts of society and science in order to meet complex challenges of society. Transdisciplinary research starts from tangible, real-world problems. Solutions are devised in collaboration with multiple stakeholders' (Klein et al. 2001: 7).

Key features of transdisciplinary research

In recent years, various authors have conducted literature reviews in search of a shared definition of transdisciplinarity (e.g. Stock and Burton, 2011; Pohl, 2010; Pohl and Hirsch Hadorn 2007) and found a plethora of concepts, approaches and perspectives, but also a set of widely shared features, combining aspects of both perspectives sketched above. First, there is general consensus at present that transdisciplinary research should respond to real world problems; in particular problems that have proven to be persistent in nature. Second, as a result of the focus on real world problems, multiple stakeholders are involved. Third, in order to resolve real world problems, different forms of knowledge need to be integrated, crossing disciplinary boundaries as well as boundaries between science and society. Fourth, in transdisciplinary research the process of knowledge production is integrated with the process of societal problem solving. Finally, transdisciplinary research is an iterative process that follows an emergent design.

Real world problems

In the 21st century, human societies are confronted with a range of problems that are persistent in nature: social exclusion of marginalized groups, the vicious circle of poverty and health problems, environmental problems as a result of industrialisation, problems of food safety in the food chain, etc. These problems are hard to understand because of their complexity, difficult to deal with in the sense that solutions to these problems are constrained by features embedded in the system, and difficult to manage because they require the actions of different actors with different interests, views and needs. These problems are referred to as 'wicked' problems (Rittel & Webber, 1973), unstructured problems (Douglas & Wildavsky, 1982, Hisschemöller and Hoppe, 1996) or problems of organized complexity (Mason & Mitroff, 1981). Wicked problems 'defy efforts to delineate their boundaries and to identify their causes, and thus to expose their problematic nature' (Rittel & Webber, 1973: 167). As these types of persistent problems do not fit into specific disciplines, or into clearly defined policy domains, they are by no means easy to

resolve. It is for these kinds of problems that pleas have been made for a different kind of knowledge production: transdisciplinary research, which refers to a process of joint knowledge production and problem solving by actors from both science and society centred around *tangible, real world problems* (see e.g. Klein, 2001: 7). As Mittelstraß argues:

> *[T]ransdisciplinarity refers to knowledge or research that frees itself of its specialised or disciplinary boundaries, that defines and solves its problems independently of disciplines, relating these problems to extra-scientific developments.* (Mittelstraß 1992: 250, translated by and cited in Bunders et al. 2010: 128)

In addition, the Swiss Network for Transdisciplinarity (td-net)[11] explicitly takes the aim of addressing socially relevant issues as the starting point for transdisciplinary research (Pohl, 2010).

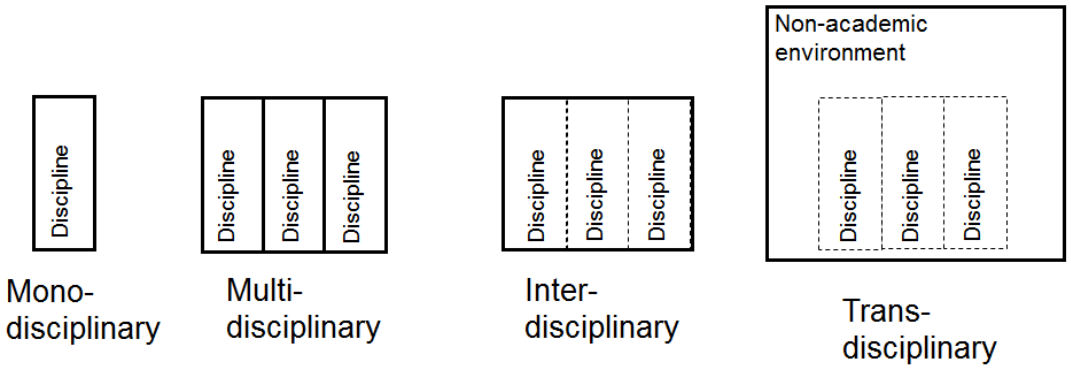
Multiple actors

Starting with fuzzy, ill-defined, real world problems implies that issues are not formulated from the viewpoint of a scientific discipline. Rather, in a transdisciplinary approach, the issues, and therefore the required expertise, are formulated from the context of the problem:

> *Transdisciplinary research […] denotes interdisciplinary cooperation, involving not only scientists but also practitioners from beyond the realm of science (for example the users) in the research work.* (Defila and Di Giulio 1999: 13)

Scientists and other societal actors generate new knowledge in mutual exchange which helps to clarify the problem and generate possible solutions. The involvement of practitioners, or non-academics, is seen as the most important feature that distinguishes transdisciplinary research from interdisciplinary research (see e.g. Bunders et al. 2010, Mobjörk 2010, Stock and Burton 2011).

Fig. 1 Distinguishing mono-, multi-, inter- and transdisciplinary research



Only by involving end-users, practitioners, policy-makers and/or entrepreneurs in the process of knowledge production, can the proposed solutions be socially relevant, supported and applicable. In transdisciplinary research, societal actors are involved in all phases of the research process, from problem identification and structuring, to analysis and implementation (Hirsch Hadorn et al. 2008, Bunders et al. 2010). It is an 'extended knowledge production process' (Mobjörk 2010, Funtowitsch and Ravetz, 1993) in which scientists with different disciplinary backgrounds as well as relevant societal actors bring together their knowledge, expertise, skills and perspectives. For the process of joint problem definition, different methods are applied to collectively investigate the complexity of a system (e.g. actor analysis, causal analysis, system analysis) (Bunders et al. 2010, for description of tools and methods see Mierlo van et al. 2010 and Regeer et al. 2010).

We want to make a distinction here between a unidirectional approach[12], in which non-academics are involved in the research process to generate 'better' or 'more adequate' knowledge, and a multidirectional approach in which multiple societal actors, including scientists, together search in a joint deliberative process to find solutions to complex problems (see Figure 2). In the unidirectional approach non-academics participate, their views are included, but the primacy essentially remains with academia, whereas in a multidirectional approach the collaboration is truly heterogeneous and centred around the issue at hand (see also Regeer and Bunders 2009: 42-43).

Figure 2. Different forms of involvement of actors in transdisciplinary research on a gradual scale

Involve non-academic actors in research process

Multi-actor process around complex problem

Knowledge integration

Transdisciplinarity corresponds with the idea that not only scientific knowledge is relevant for the resolution of persistent societal problems, but that social knowledge and experiential knowledge are also important. The different perspectives on the issue come together in a learning process. During this interactive process, tacit knowledge is made explicit and new knowledge is constructed, shared and tested. Mutual learning is enhanced in focus groups, round tables, expert sessions, stakeholder dialogues, etc. Depending on the societal issue in question, mono-, multi-,

interdisciplinary or experiential knowledge will, to a greater or lesser extent, be introduced and created. In this kind of process, 'socially robust knowledge' is generated. Nowotny et al. (2001) argues that socially robust knowledge is not only scientifically reliable, but is also accepted and applicable in the societal contexts in which the relevant issue occurs (see also Regeer and Bunders 2009).

Integration of the research and change processes

The perspective outlined above implies that it is hard to distinguish between the process of knowledge development and the process of problem-resolution in the context of transdisciplinary research. As a consequence, the main responsibility for solving persistent problems does not rest unequivocally with one of the domains concerned: both the scientific and societal domains are actively seeking the best way of structuring and managing change processes. It is a joint process centred on an ill-defined, societally relevant, real world problem that could be initiated outside academia (government, industry, public, NGOs) or by scientists (Bunders et al. 2010).

A transdisciplinary research approach thus goes beyond measuring and understanding the issues but includes transformative action as part of the research process. Transdisciplinary research includes the perspectives of many different actors from both society and academia to gain an in-depth understanding of the problem, as well as the collaborative design of possible strategies to deal with the problem, testing and evaluating these strategies in practice. At the same time, transdisciplinary research has a systematic, rigorous research approach and a strong theoretical base. In this way transdisciplinary research can improve theory and take positive action simultaneously.

Note that there is no general consensus on this perspective. The review on multi-, inter- and transdisciplinary sustainability research by Stock and Burton (2011) for instance shows that there is some degree of contention as to whether the criterion 'involves implementation as part of the process' is necessary for transdisciplinary research or not. For many, transdisciplinary research may only involve socially relevant research, which is then handed over to stakeholders to implement. We, personally, feel however that in the quest to truly address urgent but persistent societal problems, various boundaries are transgressed: boundaries between science and society, between research and problem-solving, and between knowledge production and implementation. Real-life examples of transdisciplinary research include:

- the involvement of physicians, medical specialists, healthcare insurers, patients, and citizens in the creation of a national policy on rational drug use or a research agenda on medical products;
- the creation of a dialogue between researchers, environmental organizations, the business community, and policymakers on innovative and creative solutions for the problem of climate change; and
- the development of a business proposition around new diagnostics that would appropriate for application in developed and developing countries.

Emergent design

Transdisciplinary research is characterized by an explicit 'emergent design' (see also van Veen et al *In review*). At the start of an emergent process, the proposed action is described in global terms, and only in subsequent phases is the process planned in more detail. On the basis of observation and reflection, the subsequent phases acquire structure and meaning. This is because societal change processes are often unpredictable and develop en route. The path towards change may seem clear beforehand, but obstacles and opportunities may require an alternative route that yields less resistance. Moreover, as new insights are gained in the process of inquiry, objectives and strategies may be re-defining, changing the scope and practice of the process (Smith and Hauer, 1990). Guba and Lincoln (1982), in their considerations on the epistemological and methodological bases of natural inquiry, state that a fixed design, agreed in advance, is unsuitable for inquiry in real world settings. They suggest that, rather than specifying all steps of the process beforehand, designs should be emergent; they unfold as time and events proceed. Adopting an emerging design process implies that 'changes are built in with conscious intent' (Guba and Lincoln, 1982: 247), involving a process of volition. Thus, the adaptive nature of transdisciplinary processes in the context of wicked problems demands an emergent approach that is characterised by cycles of plan-action-observation-reflection (see Fig. 3).

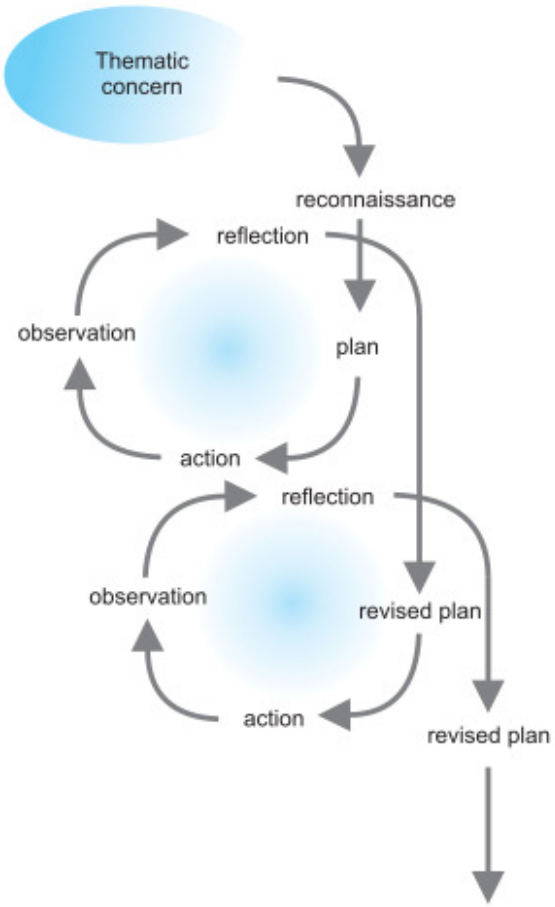
The process involves an ongoing reconsideration and redefinition of the problem at hand on the basis of new experiences and observations. Given the complexity involved, it is not sufficient to start with an exercise to structure and define the problem with a small group of participants, followed by rolling out of the project. Instead, subsequent events will throw a different light on the problem, requiring different actions. Moreover, involving other actors at later stages has consequences for the perception of the problem as they contribute different values, views and knowledge. The inner circle of participants' understanding of the problem may need to be revised, adjusted, or complemented in a subsequent phase (Regeer et al. 2011).

An action learning approach, as the phrase implies, is not just about reflection, but also about action. It is 'a continuous process of learning and reflection [...] with the intention of getting things done' (McGill and Beaty 1995: 21). Action, observation, reflection, and the revision of ideas, insights, and plans continuously alternate, or even take place at the same time. This may happen at different speeds and at different levels. At one particular moment, a small observation-reflection-plan-action cycle may take place (a reflection on what happens and an immediate response). An action may also take place after a meeting, and be reflected upon one month later, in the next meeting. It may also be possible to distinguish three large learning cycles in a two year project so that the action-learning spiral will support the iteration between exploration, development and implementation (see Regeer et al. 2011). Five of the main features of transdisciplinary research, as described in this paper, are summarized in Box 3.

Box 3: Key features of a transdisciplinary approach

- Transdisciplinary research starts with real world, persistent or wicked problems.
- Multiple actors are involved in identifying, defining, analysing and developing solutions for the problem.
- Both explicit and tacit, academic and experiential, certified and non-certified knowledge is integrated in the process.
- Transdisciplinary research is transformative in nature and, by involving all relevant actors, engages in both research and change.
- A transdisciplinary research process follows an emergent design.

Figure 3: Action research spiral



Source: Kemmis and McTaggart 1988: 154.

A fifth generation of knowledge management for development

As mentioned in the previous sections on generations of KM4D, KM approaches for development originated in the KM mainstream which focuses on organisations and networks in the developed world. However, this orientation to mainstream KM appears to be changing and a fifth generation of KM4D can be identified that bears an increasing resemblance to key features of transdisciplinary research. The fifth generation of KM4D is identified as the 'development knowledge system' or 'development knowledge ecology' (see Cummings, Pels and Powell 2012 for a description of the characteristics of the development knowledge ecology) which emphasises the linkages between the different elements of the system. This generation of KM4D is characterised by the following:

- a growing awareness of multiple knowledges and multi-stakeholder processes in the solution of 'wicked problems';
- recognition of the importance of the development knowledge as a global public good and of the development knowledge commons;
- understanding the role of knowledge in endogenous development;
- an increasing emphasis on cross-domain interactions and knowledge co-creation; and
- recognition of the importance of complexity and emergence.

These diverse but interlinked perspectives are having a great impact on the field of KM4D and we will outline them in more detail below. However, it is important to bear in mind that although fifth generation approaches are emerging, they co-exist with previous generations of KM4D.

This description of the proposed fifth generation of KM4D is normative because we, personally, are of the opinion that this is the desired direction for KM4D. Although some of these trends are clearly emerging, others are, as yet, less clearly obvious. The less obvious ones comprise attention to the knowledge commons and an emphasis on the role of knowledge in endogenous (internally generated) development.

Multiple knowledges and multi-stakeholder processes

Just as in transdisciplinary research, the idea of multiple knowledges is a key tenet of current understandings of KM4D (Brown 2008, 2011). Multiple knowledges are enshrined in all individuals and involve individual, community, specialist, organisational and holistic knowledge (Brown 2008). Resolution of complex, socially embedded problems involves different types of knowledge. More and more, there is an acknowledgement that the central real world issues of development cannot be solved by one party, one discipline or one type of knowledge.

Understandings of multiple knowledges also call for a proliferation of different kinds of multi-stakeholder processes which are variously labelled round tables, communities of practice, platforms, partnerships and networks. Whatever term is used, these multi-stakeholder processes

have to be designed to both anticipate and respond to the diversity of knowledges each party brings and requires, and the level of complexity of a situation at hand.

The development knowledge commons

In this new generation of KM4D, intellectual property rights become all important because they can stop the flow of knowledge and, thus, form a barrier to development. In consequence, a key feature of fifth generation KM4D is the concept of the understanding of knowledge as a global public good (Stiglitz 1999). In recognition of development knowledge as global public good, Ferreira (2012) has investigated the related development knowledge commons (Ferreira 2012), influenced by the work of Nobel Prize winner, Elinor Ostrom and colleagues. According to Hess and Ostrom, the knowledge commons represents:

> *…a new way of looking at knowledge as a shared resource, a complex ecosystem that is a commons – a resource shared by a group of people that is subject to social dilemmas.* (Hess and Ostrom 2007a: 3)

Based on the work of Elinor Ostrom on sustainable ways of managing natural resource commons, Hess and Ostrom (2007b) have developed and adapted a model to analyse the knowledge commons which has five components: resource characteristics, action arena, patterns of interaction, outcomes, and evaluative criteria. Resource characteristics comprise biophysical-technical characteristics, attributes of the community, and rules-in-use. The biophysical-technical characteristics of the knowledge commons have three levels: facilities (such as libraries), artefacts (or objects, such as books) and ideas. Traditional knowledge objects, such as printed books, are supposedly rivalrous because only one person can read them at a time whereas digital books and articles are non-rivalrous because multiple copies can be made and they can be read simultaneously by many people if they have access to the Internet. This represents a fundamental difference between physical resources (water, soil, plants) and digital knowledge objects.

The development knowledge commons is an important feature of the development knowledge system or ecology because without the establishment of a knowledge commons, much knowledge will remain in the hands of commercial interests, protected by intellectual copyright laws and will not be accessible to for those who need this knowledge to develop.

The role of knowledge in endogenous development

Mansell (2010) argues that there are two opposing models on development of information and communication technologies (ICTs), namely the exogenous paradigm of development in which development is externally generated and the endogenous paradigm[13] in which development is internally generated (Mansell 2010). In the fifth generation of KM4D, the emphasis needs to be on local, endogenous development as expressed in this definition of development:

Table 2: Five generations of KM4D

Generations of KM4D				
1: ICT-based	**2: Organisation-based**	**3: Knowledge sharing-based**	**4: Practice-based**	**5: Development knowledge system/ecology**
Identifying concepts				
Knowledge as a commodity	Knowledge as an asset within organisations	Knowledge sharing between organisations	Knowledge processes embedded in organizational processes	Cross-domain knowledge integration and knowledge co-creation
Features				
ICTs Databases Portals Clearinghouses	KM audits KM scans Explicit and tacit knowledge	Peer assist Case studies 'Best practices' Inter-organization communities of practice	Role of social media People-centric Practice-based	Multiple knowledges Multi-stakeholder processes Global public good and development knowledge commons The role of knowledge in endogenous development Emergence and complexity

> *Development is, most of all, the result of the synergy among millions of innovative initiatives people take every day in their local societies, generating new and more effective ways of producing, trading, and managing their resources and their institutions. The work of policy makers and development agencies may contribute greatly to the success of those initiatives, may shape them, or may undermine those efforts.* (Ferreira, 2009: 99)

In this local, endogenous process, knowledge has a key role because it is at the basis of innovation. The paper by Denise Beaulieu in the Special Issue 'Diversity and tensions in knowledge production and dissemination: a closer look at the activities of 10 civil society organisations in Ghana' is also relevant to this theme of endogenous development because it illustrates the difficulties these organisations face in getting their voice heard, despite the fact that they represent a legitimate endogenous voice in the policy arena.

Emergence and complexity

As we learn more about the nature of complex social systems, it becomes increasingly clear that 'top down and linear' strategies for change do not work (see Ramalingam et al. 2008; Jones, 2011). In more recent years, we see the rise of KM4D approaches that are much more non-linear and adaptive in nature. Indeed, there is an increasing understanding that societies, economies and ecosystems do not behave in linear and mechanical ways, namely that they are complex adaptive systems. According to Ramalingam and colleagues (2008) much has been written about emergence, in fields varying from behaviour of fluids, traffic jams to political systems. Emergence describes how overall properties of a complex system emerge from interconnections and interaction of the parts, such that the whole is different to the sum of the parts. Hence, while the nature of the entities, interactions and environment of a system are key contributors to emergence, there is no simple relationship between them. A system involves more than the rules of the game, and there is no hierarchical 'top-down' control. In consequence, the total system cannot be understood by simply looking at the individual parts.

The principles of emergence imply that over-controlling approaches will not work well within complex systems and that, in order to maximise system adaptiveness, there must be opportunity for innovation and novelty to occur. (Ramalingam et al., 2008: 32). By implication, grand designs may overly exert control while '… the key is to minimise central controls, and to pick just those few rules which promote or permit complex, diverse and locally fitting behaviour' (Chambers et al 1997 in Ramalingam et al., 2008: 32). This is a key point that increasingly informs the design and facilitation of KM4D approaches.

Emergence has an enormous influence on how knowledge creation processes and KM4D approaches are perceived, designed and facilitated. An important consequence is, among others, a radical shift from a static understanding of knowledge (knowledge as a commodity that can be codified) to a much more dynamic, fluid and adaptive approach. Bringing in and valuing

knowledge from multiple stakeholders is a dominant feature in the KM4D strategies that have complexity at heart.

KM4D meets transdisciplinary research

Based on the descriptions of both fields in the sections above, we argue that there are similarities emerging between KM4D and trandisciplinary research and that the field are, in some aspects, converging and mutually enriching. Development issues are increasingly recognised to be complex wicked issues demanding a knowledge intensive approach which has forced KM4D to take on certain strategies and methods. At the same time, we argue that KM4D can learn from transdisciplinary research and that transdisciplinary research can learn from KM4D in some ways too. However, given that this journal is primarily about KM4D, the main emphasis will be on what KM4D can gain.

Convergence between KM4D and transdisciplinary research can be grouped into four main areas: the focus on real world problems in complex situations, the involvement of multiple actors, new processes and methodologies, and knowledge integration and co-creation. However, it must be noted that this convergence largely relates to fifth generation KM4D and with there is far less overlap with the other generations.

Real world problems in a situation of complexity

The first and primary similarity is the focus on real world issues. In both field, these issues comprise complex or wicked problems where there is no simple solution. In many cases, these issues are unknowable and systemic in nature, and have emergent properties.

Multiple actors

The second similarity comprises the methodological principle of the need for multi-stakeholder involvement. This is because these real world issues are the concern of diverse stakeholder groups and because possible solutions or resolutions cross stakeholder boundaries and intervention levels. Third, and very much related, these issues demand the inclusion of the user's perspective, both as knowledgeable subjects and as the party that has to cope with the risks and consequences.

Processes and methodologies

A last similarity relates to the adoption of adaptiveness rather than linearity in design and, implementation of transdisciplinary and KM4D processes. In attempts to tackle real world issues, both fields demonstrate converging methodological principles. This has resulted in an explosion of methodologies and tools which aim to generate and support adaptive change processes geared around progressive learning. Examples are adaptive planning, reflexive monitoring, pathway approaches and methods (see, for example, van Mierlo et al. 2010). These methodologies and tools cannot be used in isolation. For example, adaptive planning involves appropriate

monitoring and evaluation (M&E) because working in an adaptive way requires the systematic connection between M&E and learning in order to inform and improve strategy. In short, throughout the process stakeholders critically and purposefully reflect (jointly) on what they are doing (outcomes/result) and how they are doing (process), and use these lessons to improve their future work (in planning and action). Crucial is that the learning feeds back into new strategies and adapt according to the changes. A further similarity concerns the embracing of participatory approaches which often guiding the multi-stakeholder process. While neither transdisciplinary research nor KM4D can claim exclusive use of these adaptive methodologies and tools, the fact that both increasingly use them does underline increasing convergence between the two fields.

Knowledge integration and co-creation

In addition, both fields perceive and think about knowledge generation processes as broader than conventional science and involving more than academic actors.

What can KM4D learn from transdisciplinary research?

The increasing convergence of the two fields makes it difficult to identify what KM4D can learn from transdisciplinary research because both fields are evolving in similar ways. However, we argue that KM4D can continue to learn from transdisciplinary research because of its strong theoretical underpinning, its creation of new knowledge of relevance for KM4D, the way it is able to place knowledge processes within a broader societal perspective, and because of its methodological approaches.

Theoretical underpinning

The stronger theoretical underpinning of academically-inspired transdisciplinary research can assist KM4D by improving its understanding of innovation and change processes and by contributing to conceptual understanding of the role of knowledge. For example, one aspect of the theoretical underpinning of transdisciplinary research, namely transition theory, can assist KM4D practitioners in their efforts to change development practice and to bring about social change in a complex environment. Transition theory with its understandings of structuring elements within a complex system (culture, structure and practices), the multi-level perspective of niches (micro-level), regimes (meso-level) and landscapes (macro-level); the possibility to anticipate the direction of the transition by analysis of its multiple phases; and its predictions for the conditions of transformational change can aid practitioners in their understanding of the nature of change and innovation in complex adaptive systems. In this issue, the paper by Alida van der Ham and colleagues 'Towards integration of service user knowledge in mental healthcare in low income countries: insights from transition theory' links the perspective of transition theory to system-wide change processes.

In another example, the stronger theoretical underpinning of transdisciplinary research is also able to contribute to a deeper understanding of the role of knowledge in development processes.

For example, the paper by Beatriz Miranda-Galarza and colleagues in this issue 'The power of personal knowledge: reflecting on *conscientization* in lives of disabled people and people affected by leprosy in Cirebon, Indonesia' – and particularly the discussion of the political nature of personal knowledge, critical consciousness and reflection – add a considerable dimension to KM4D's current understanding of multiple knowledges.

Contribution of new knowledge

Transdisciplinary research is also contributing to the development of new knowledge relevant to KM4D as can also demonstrated by a number of papers in this Special Issue. For example, a new sub-field within KM4D appears to be emerging, focused on the role of knowledge in disability inclusive development. Indeed, Beatriz Miranda-Galarza and colleagues' paper, mentioned above, and the contributions by Saskia van Veen and colleagues 'Mutual learning for knowledge co-creation about disability inclusive development: experiences with a community of practice' and Ruth Peters' short story 'A reflection on positionality and knowledge processes in transdisciplinary research' represent some of the first formal research contributions to this new and emerging sub-field of KM4D.

An emphasis on the wider systemic issues of knowledge

As the papers in this Special Issue also demonstrate, transdisciplinary research can also aid KM4D in its efforts to address the wider systemic issues of knowledge. For example, the paper by Andrea Solnes Miltenburg and colleagues 'Reflections on the dynamics of the coexistence of multiple knowledge cultures in a community-based maternal health project in Tanzania' convincingly places the knowledge cultures of women and maternal health professionals within the broader context of maternal health within the national system of Ethiopia. In addition, the paper by Valerie Brown and John Harris 'Transformation science: seven collective questions for a just and sustainable future' offers a framework for inquiry in sustainable development that draws on the full range of human experience, all of which needs to be considered under conditions of development and transformational change. Such approaches take the earlier generations of KM4D out of their comfort zone.

Methodological approaches

KM4D can also learn from the methodologies of transdisciplinary research. The paper by Sarah Harlan and colleagues 'Mapping networks to improve knowledge exchange among family planning and reproductive health organisations in Ethiopia' illustrates the methodological changes developing at the cusp of these two fields. Although both fields employ participatory approaches, it might be possible for KM4D to learn from explicit experience with applying a degree of scientific rigour to the wide range of participatory methodologies, which is to be found in transdisciplinary research, including in-depth interviews, focus group discussions, photo-voice and many more. In particular, transdisciplinary research's approach to the triangulation of quantitative data might also be useful to KM4D.

Knowledge integration and co-creation

Although, as we mention above, there are signs of convergence between KM4D and transdisciplinary research in their understandings of knowledge integration and co-creation, there is no doubt that transdisciplinary research has, ironically, more experience with these knowledge focused processes than KM4D. For example, Wenny Ho's contribution to this Special Issue, 'Guidelines for knowledge integration: navigating a myriad of perspectives' provides parameters for the use of knowledge integration in social change and innovation programmes, based in the literature and approaches developed by transdisciplinary research.

What can transdisciplinary research learn from KM4D?

Transdisciplinary research can learn from KM4D's explicit approaches to knowledge and learning, particularly from notions of tacit knowledge, and first and second loop learning. The paper by Jeroen Maas and colleagues illustrates the fact that concentrating on knowledge and learning processes can make it possible to identify the developing nature of social entrepreneurship among poor women in Bangladesh. KM4D can specifically contribute to transdisciplinary research by its explicit focus on key knowledge concepts such as tacit and explicit knowledge, and notions of formal and informal learning processes

Concluding remarks

Trandisciplinary research is based on the understanding that scientific knowledge alone cannot resolve persistent and wicked problems, emphasising the role of socially robust knowledge and experiential knowledge. Although these insights are not new to those in the field of KM4D, the theoretical grounding can add new perspectives to the practice of KM4D. In addition, the emphasis of transdisciplinary research on the breaking of boundaries is of interest to KM4D: the breaking of boundaries between science and society, between research and problem solving, and between knowledge production and implementation. Although KM4D can take place without the presence of transdisciplinary researchers or a trandisciplinary approach, transdisciplinary research can make an important contribution in terms of theoretical underpinning. For example, multiple knowledges (Brown 2008, 2011) has provided KM4D with a conceptual framework which recognises the importance of individual and community knowledge, while transition theory can help KM4D practitioners understand why their innovative experiments at niche level (micro level) are difficult to scale up to regime (meso-level) and landscape (macro-level). At the same time, KM4D can specifically contribute to transdisciplinary research by its explicit focus on knowledge processes and learning. Cross-fertilisation and synergy between the two fields is also stimulated by the fact that both are focused on addressing real world problems and, ultimately, improving human lives.

This Special Issue comprises, in addition to this article, some 10 contributions. Of these, some seven have been written by transdisciplinary researchers while only three come from KM4D practitioners and researchers. This brings us to the conclusion that the transdisciplinary

researchers seemed better able to adapt to the challenge of using a KM4D lens. However, for the transdisciplinary researchers, it was not an easy process. For example, one of the transdisciplinary authors struggled very hard to view her own work from a knowledge perspective with numerous versions before the paper was eventually sent for peer review. In all, the Guest Editors believe that this Special Issue provides readers from both traditions with new insights into and stimulating examples of breaking the boundaries to knowledge integration.

The various articles in this Special Issue provide insights into what this new paradigm of fifth generation KM4D may entail. Although the fifth generation KM4D sketched in this paper is 'work in progress', we hope it inspires and enlightens KM4D practitioners and researchers alike and believe it offers much room for action, experimentation, and reflection. These reflections will be presented in future issues of this journal.

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[1] www.km4dev.org
[2] Throughout this paper, a distinction is made between the community (KM4Dev) and the field (KM4D).
[3] https://dgroups.org/groups/km4dev-l/
[4] http://wiki.km4dev.org/Transboundary_learning_and_innovation_for_development
[5] www.ikmemergent.net
[6] See http://linkingknowledgedomains.wordpress.com/ for an overview for some from 2012
[7] http://www.km4dev.org/group/km4dev09crosscuttinghuddle
[8] Source http://wiki.ikmemergent.net/files/80310_IKM_Working_Paper_No._1_Meta-review_and_scoping_study.pdf and http://www.ikmagazine.com/xq/asp/txtSearch.CoP/exactphrase.1/sid.0/articleid.C5F24E58-6698-4AA9-8617-595E68332C15/qx/display.htm
[9] The section 'history of transdisciplinary research' is largely based on Regeer and Bunders (2009) 'Knowledge co-creation: interaction between science and society. *A transdisciplinary approach to complex societal issues*' p. 36-38
[10] http://siti-server01.siti.disco.unimib.it/~maclab/kmia/pdf/milanfinal-huysman.pdf
[11] http://www.transdisciplinarity.ch/e/
[12] Note that we use the term 'unidirectional' in a different sense than Jakobsen et al. (2005) do in the context of interdisciplinarity, see Stock and Burton (2011: 1097).
[13] Kindly note that endogenous development is internally rather than externally driven and determined. It differs from indigenous knowledge, namely local or traditional knowledge, because endogenous development should be based on many different sources of knowledge