

# A METHOD TO REVIEW AND REPORT LITERATURE IN TRANSDISCIPLINARY RESEARCH UNDERTAKEN BY INDIVIDUAL RESEARCHERS

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## **Abstract**

Projects aiming to solve socially-relevant complex problems in general and sustainability related projects in particular are increasingly approached as transdisciplinary research projects. The distinguishing characteristics of transdisciplinary projects require development of unique strategies to overcome difficulties resulting from the absence of disciplinary frameworks and broadness of issues needing to be covered. Since transdisciplinary research requires broad preparation, it is particularly challenging to undertake at Ph.D. level where, traditionally, the researchers are expected to work individually. Even though review of literature in transdisciplinary research has been acknowledged as one of the challenges of transdisciplinary research, no systematic way of approaching this challenge has been proposed so far. The aim of this paper is to present a method developed to help Ph.D. researchers undertaking transdisciplinary projects in systematic structuring and prioritisation of literature review/reporting process. In this method, the transdisciplinary researcher identifies and reflects on a long-term vision that he/she aims to contribute towards its achievement. Identification of a vision is the starting point for setting filters in order to narrow the literature review. Further narrowing is done through an iterative process of identifying other filters by inquiring about the mission, context and content of the research and by answering some reflective questions. A recently finalised Ph.D. research on system innovation for sustainability at product development level is used as a case study to exemplify the use of the method.

## **Keywords**

*transdisciplinarity, transdisciplinary research, research methods, Ph.D. education*

## **1. Introduction**

There is a richness of definitions of transdisciplinary research and a general understanding is still developing (Bergmann et al., 2005). However, the commonly cited characteristics of transdisciplinary research in recent literature (e.g. Bergmann et al., 2005; Guggenheim, 2006; Hirsch Hadorn, Bradley, Pohl, Rist & Wiesmann, 2006; Loorbach, 2007; Max-Neef, 2005; Pohl & Hirsch Hadorn, 2007; Späth, 2008; Wickson, Carew & Russell, 2006; Wiek, 2007; Zierhofer & Burger, 2007) are:

- aiming to solve socially-relevant real-life problems;
- collaboration/Participation;
- evolving methodology;
- epistemological and methodological integration;
- normativity (transformation agenda), and;
- contextuality.

The distinguishing characteristics of transdisciplinary projects have implications on how the research needs to be undertaken and evaluated. In most cases, unique strategies need to be developed to overcome the associated difficulties and to assure the research quality in the absence of disciplinary frameworks. Broad preparation is identified as a quality requirement for transdisciplinary research (Carew, 2004; Wickson et al., 2006; Mitchell & Willetts, 2009). Broad preparation requires covering a very wide area of literature. Covering a very wide area of literature is particularly significant for those researchers undertaking a PhD project since, traditionally, these researchers are expected to work individually.

Even though review of literature in transdisciplinary research has been acknowledged as a challenge (e.g., Carew, 2004), no systematic way of approaching it has been proposed so far. This paper presents a method developed to help PhD researchers undertaking transdisciplinary projects in systematic structuring and prioritisation of literature review/reporting process.

## **2 The Pyramid of Transdisciplinarity**

Disciplines establish a frame of reference for academic rigour and act as a common ground for coordinated judgement in line with predetermined quality standards defined through disciplinary epistemological filters and methodological approaches. However, disciplinarity is about mono-discipline and individual researchers in disciplinary contexts specialise in isolation (Max-Neef, 2005). Despite the undoubted utility and historical success of disciplinarity in scientific knowledge generation, specialisation in science has had some negative implications as well (Burger & Kamber, 2003).

The specialisation in science and fragmentation of knowledge through establishment of disciplinary boundaries and thematic fields contrast with the complex and systemic character of the real-world and its problems as well as with the open structure of ever-evolving knowledge (Max-Neef, 2005; Hirsch Hadorn et al., 2008). Disciplinary distinctions become trained incapacities (Rosa & Machlis, 2002) and therefore specialisation also prevents recognition of its own side effects (Hirsch Hadorn et al., 2008).

In order to overcome the above mentioned limitations, different approaches which cross boundaries of mono-discipline have been proposed and used. In multi-disciplinary research, methodologies from more than one discipline are applied in an unintegrated fashion (Wickson et al., 2006). Multi-disciplinary research is a juxtaposition of theoretical models from different disciplines (Ramadier, 2004). Therefore, in this type of research, scientists from different disciplines use their own methodologies and report their own analysis without any integrating synthesis (Max-Neef, 2005). In interdisciplinary research there is consensus on theoretical models, problem formulation and a shared methodology which is derived from different disciplines (Ramadier, 2004; Wickson et al., 2006). In this type of research, there is both integration and coordination; however, coordination takes place at two levels where a lower level is coordinated by a higher one (Jantsch, 1972; Max-Neef, 2005).

Max-Neef (2005) pointed out that instead of two, there should be four hierarchical levels in coordination of the disciplines. He developed the pyramid of transdisciplinarity (Figure 1) in order to explain these four levels which were initially suggested by Jantsch (1972) more than thirty-five years ago in the context of a systems approach to education and innovation. These four levels are empirical level (i.e. basic disciplines such as biology, chemistry, physics, sociology, etc.), pragmatic level (i.e. applied disciplines such as architecture, engineering, etc.), normative level (i.e. normative disciplines such as planning, politics, social systems design, etc.) and values level (i.e. ethics, philosophy and theology).

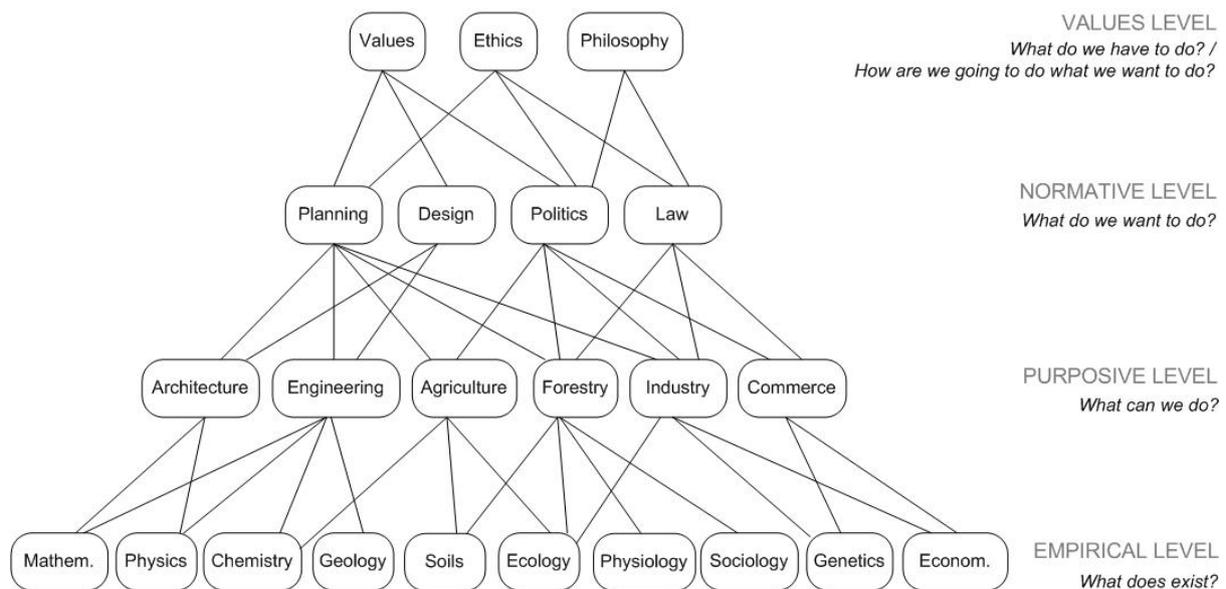


Figure 1: The Pyramid of Transdisciplinarity (Adapted from Max-Neef, 2005, p. 9)

In this four level pyramid, the lowest (empirical) level comprises of disciplines which attempts to answer the question ‘what does exist?’. The second (pragmatic or technological) level from the bottom attempts to answer the question ‘what can we do?’ by using the knowledge of the first level. The third (normative) level attempts to answer the question ‘what do we want to do?’. The question answered by upper-most (values) level is either ‘what should we do?’ or ‘how should we do what we want to do?’. In transdisciplinarity, all of the four levels are coordinated in research and knowledge generation.

### 3 The Challenge of the Individual Transdisciplinarity Researcher

Transdisciplinarity emerged as an alternative approach to disciplinary structure as a result of the historical problems related to disciplinarity (Guimarães Pereira & Funtowicz, 2006). Nevertheless, transdisciplinarity does not imply a dissolution of disciplines (Lenhard, Lücking & Schwechheimer, 2006). On the contrary, for transdisciplinarity to be possible, the system of disciplines needs to be in place (Ramadier, 2004; Guggenheim, 2006). However, in a transdisciplinary approach to research and knowledge generation, disciplines are neither epistemologically nor methodologically closed, but, on the contrary they are ready to be transformed through the transdisciplinary experience to enable generation of solutions for the identified socially-relevant real-life problems (which cannot be solved effectively with a disciplinary approach). This highlights integration as an inherent and arguably the most challenging characteristic of transdisciplinary research.

In transdisciplinary research, there are different types and dimensions of integration. Among these different dimensions, epistemological integration between different disciplines, integration of empirical, experiential and intuitive types of knowledge, integration of qualitative and quantitative knowledge, integration of theoretical and practical knowledge, integration of researcher with the research subject and integration of different levels of reality can be counted (e.g. Scholz & Tietje, 2002; Burger & Kamber, 2003; Bergmann et al., 2005; Max-Neef, 2005; Wickson et al., 2006; Zierhofer & Burger, 2007; Pohl, Van Kerkhoff, Hirsch Hadorn & Bammer, 2008). An important point is that, the concept of and the effort put in integration does not imply a unity of knowledge (Ramadier, 2004). Ideas of theorists of transdisciplinarity suggest that, rather than the futile effort of trying to establish a unity of knowledge, integration should be aimed by looking for similar patterns and coherence across different disciplines and, by articulating and communicating these convergences (Wickson et al., 2006).

The need for integrating different disciplines both epistemologically and methodologically in transdisciplinary research poses a specific challenge for individual, especially for Ph.D. researchers. Ph.D. research, traditionally and still in majority of the world's universities is required to be undertaken by an individual researcher. Team-work for a Ph.D. project is not welcomed since success criteria include original contribution of the individual researcher to the knowledge body. Therefore, both interdisciplinary collaboration and participatory knowledge generation has to be limited in order not to jeopardise original contribution neither to risk committing plagiarism. In line with the requirement of 'original contribution', a Ph.D. graduate is expected to become the world expert in his/her area. In the lack of collaborative interdisciplinary team-work, the individual researcher carrying out transdisciplinary research faces the challenge of being have to cover a much wider literature than a disciplinary researcher. Since 'broad preparation' is identified as a quality criterion for transdisciplinary research in line with the requirement of reviewing a wide literature cross-cutting several disciplines, and since it is impossible for an individual researcher to carry out an equally in-depth review of literature in all disciplines relevant to the transdisciplinary research project, novel ways of limiting the scope of the literature review is necessary.

## 4 A Method to Review and Report Literature in Transdisciplinary Research

### 4.1 The Conceptual Model

In order to limit the scope of review and reporting of literature in transdisciplinary research, it is necessary to prioritise some material while backgrounding some other (Carew, 2004). To assist the researcher in deciding which materials to prioritise, some filters need to be used. Figure 2 provides a conceptual model developed for governing review and reporting of literature in transdisciplinary research and to set up filters to effectively and efficiently cover the literature relevant to the research.

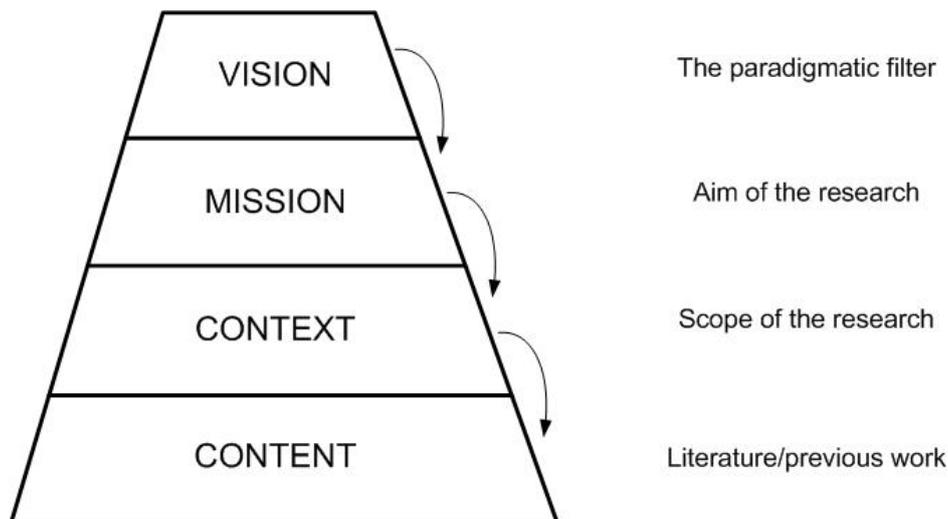


Figure 2: Governing review and reporting of research in transdisciplinary research

This conceptual model is based on the pyramid of transdisciplinarity discussed under Section 2. The first level of the pyramid of transdisciplinarity answers the question of what does exist and the entities are basic disciplines. In the conceptual model presented here, the first level corresponds to individual literature streams which cover both disciplinary and interdisciplinary areas. The second level of the model corresponds to the particular entities those literature streams apply to. This is the level where the researcher receives the knowledge (content) from the level below and applies it in real-life (context). This level in the pyramid of transdisciplinarity shows the applied disciplines and answers the question what can we do (with the knowledge we get from the level below). The third level from the bottom in the model presented here indicates the mission, i.e. the aim of the research. In the pyramid, this level answers the question “what do we want to do?”. Both in the model presented here and in the pyramid of transdisciplinarity, this level is governed by the uppermost level. In the pyramid of transdisciplinarity, the uppermost level is the values level.

In the conceptual model presented here, this level is the vision level. This level is used to set a paradigmatic filter for the research project which is aligned with the values of the researcher and what he/she desires his/her research to serve for in the longer-term.

The vision governs the entire process of prioritising material in the review and reporting of literature. The mission, i.e. aim of the research, serves to realise this vision. The mission or the aim of the research explicitly points to the scope the research focuses on. The context, i.e. scope to focus on, acts as another filter in addition to the paradigmatic filter. In the cases when one literature stream applies to more than one context, it helps to leave portion of that stream which does not apply to the context outside of review/reporting. Since there is a filtering mechanism acting from the top-down, the relevant literature at the lower-most level can be identified which applies to the particular context the aim focuses on as a means to achieve the vision. This conceptual model brings structure to the reviewing/reporting task in transdisciplinary research.

#### **4.2 Process Guidelines and Reflective Questions**

Traditionally, researchers start their research by identifying a research aim (generally after preliminary literature review). Their guiding vision is implicit and researchers do not associate it with their research. The method presented in this paper suggests researchers to consciously inquire and establish what the researcher's vision is at the beginning of the research in order to set the paradigmatic filter. This vision and filter are not specific to one particular research project but they potentially will serve in all of the (transdisciplinary) projects the researcher will carry out. This first step is once-off and will not be repeated every time when the researcher undertakes transdisciplinary research. Of course, there might be and will be changes in the vision over time but once the researcher is conscious of a vision serving in the research process, the inquiry will be automatic and will play a major role in identifying the research aim. One thing which needs to be emphasised is that the vision does not dictate the mission or the research aim but once the vision is clear for the researcher, it governs the rest of the process and aids in decision making. Figure 3 shows the process diagram demonstrating the use of the method in the wider context of a transdisciplinary research project.

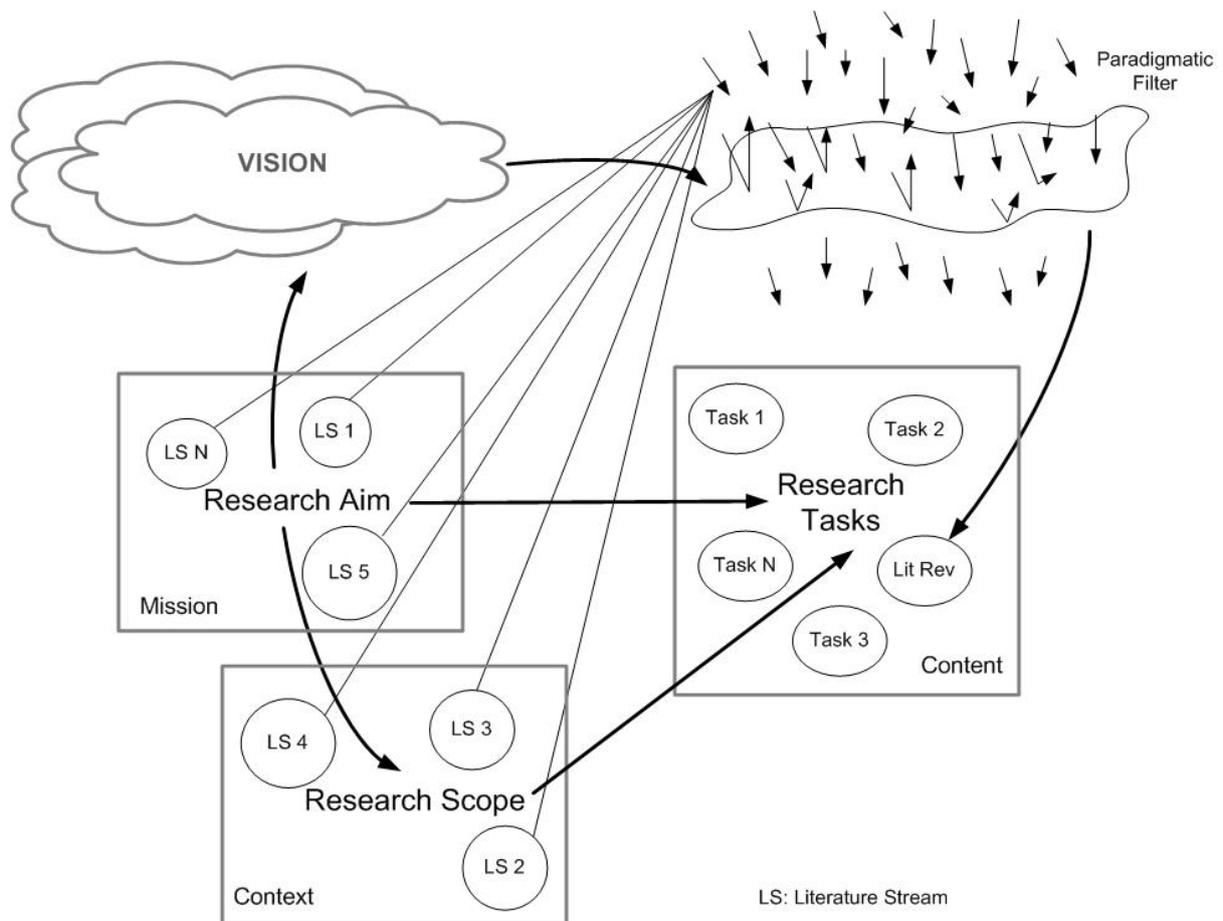


Figure 3: The process diagram for limiting the review and reporting of literature

From the research aim, the researcher derives some (generally interrelated) tasks in order to accomplish that aim. Obviously one of these tasks is literature review. Literature review serves several functions which include aiding the researcher in identifying some other research tasks. There are several iterations throughout the whole process which could not be shown in the figure. Yet initially, the research aim, implicitly or explicitly, suggests some literature streams. In transdisciplinary research, the context is predetermined by the research aim since the research is aimed to solve a particular, context-specific problem at the outset. Therefore, the scope (i.e. the context) of the project is found where the problem manifests itself even though in some projects the scope might need to be further narrowed. The scope may eliminate certain literature streams initially suggested by the research aim and act as a filter itself. Nevertheless, it also suggests certain literature streams which were not suggested by the research aim. At this point the paradigmatic filter comes into play and eases the searching, reading and reviewing task. In order to aid in the process of setting filters, some reflective questions (Figure 4) are developed to be used by the researcher.

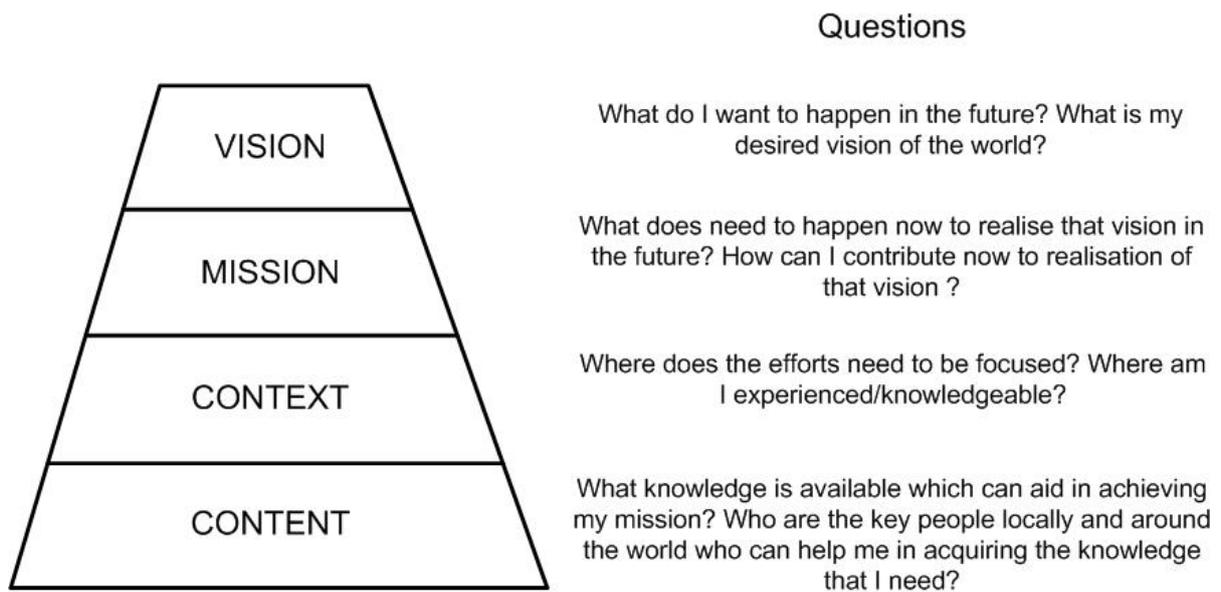


Figure 4: Reflective questions

### **5 Case Study: A PhD Research on System Innovation for Sustainability at Product Development Level**

The overall research objective of a recently finished PhD research was 'to effectively link the activities/decisions at product development (micro-innovation) level in companies with the transformation which needs to take place at the societal (macro-innovation) level to achieve sustainability'. The researcher initially identified sustainability science, futures studies, general system innovation theory, sustainability specific system innovation theory, technology futures, design futures, business futures and strategic management, sustainable product development, and business sustainability as literature streams relevant to the research objective. In order to limit the review and reporting of this vast literature the PhD researcher used the method presented in this paper. Table 1 summarises the reflections of the researcher and presents the filters set to manage the literature review process.

Table 1: Reflections of the researcher and the identified filters

<b>Levels</b>	<b>Questions</b>	<b>Reflections of the Researchers</b>	<b>Filters</b>
<b>Vision</b>	What do I want to happen in the future? What is my desired vision of the world?	I would like to see change towards a sustainable society. In the longer-run I would like the society to achieve sustainability. I would like my research to serve during this transition. Therefore, I can state that my research serves for the vision of a sustainable human presence on this world.	Sustainability; Futures studies
<b>Mission</b>	What does need to happen now to realise that vision in the future? How can I contribute now to realisation of that vision in the future?	For the society to become sustainable there is a need for massive systemic transformation which will take place over a period of time. Among other things, the active involvement of the industry in efforts related to planning for systemic transformation for sustainability is crucial. Therefore the particular mission I adopt to help realise the broader vision my research serves for is to find a way to link activities of companies to requirements of sustainability at global and societal level.	System innovation for sustainability; Business transformation towards sustainability
<b>Context</b>	Where does the efforts need to be focused? Where am I experienced/ knowledgeable at?	Industry is part of production/consumption system. The institutional, social/cultural and organisational determinants as well as technological characteristics of the production/consumption system need to be transformed. I am an engineer and have research/consulting experience in relation to technological aspects of industrial sustainability. Therefore the particular context I am interested in is technology development and the business function I am focusing on in companies is product/service development.	Sustainable technology development; Sustainable product/service development
<b>Content</b>	What knowledge is available which can aid in achieving my mission? Who are the key people locally and around the world who can help me in acquiring the knowledge that I need?	Theory of system innovation explains dynamics in the socio-technical system and presents models for transition to sustainable systems. Futures studies provides tools and methods for all levels of innovation (i.e. societal level, organisational level, technological level). There is no theory linking product development to societal level change, neither are there any methods and tools. This is the gap I identified. I can contribute to the vision and mission identified earlier by developing the required theory and a method based on that theory for the use of product development teams so that they can plan for radical systemic change. This will require me to integrate knowledge from different literature streams I reviewed. The people who can help me are my supervisor, my advisory committee, local and international experts (both academic and consulting/practicing) who work in the joint area of innovation and sustainability particularly focusing on businesses.	Methods and tools for business sustainability; Futures methods and tools for businesses; Futures methods and tools for product development; Methods and tools for innovation for sustainability; Methods and tools of knowledge integration

It was evident in the vision of the researcher that sustainability needed to act as the paradigm filter meaning that the researcher would focus on materials in the relevant literature streams which fell under the wide area of sustainability and sustainable development. After setting the paradigmatic filter, the researcher decided not to focus/report on certain futures studies methods which were developed in the growth paradigm aiming to provide wealth and power for the entity within which or for which the methods were designed and/or used without any consideration about the people and environment outside of that entity. In addition to the paradigmatic filter, i.e. sustainability, the context, i.e. technology development and product development, helped the researcher to further limit her review/reporting. For example, even though there are numerous scenario development works on regional development in the context of sustainability (e.g. Rotmans et al., 2000; Guimarães Pereira, 2001; Van Asselt, Rotmans & Rothman, 2005), the researcher decided not to report these among the findings of literature review but she only focused on projects which were about technology/product development (e.g. Weaver, Jansen, van Grootveld, van Spiegel & Vergragt, 2000; Vergragt, 2000; Elzen, Geels & Hofman, 2002; Hofman, Elzen & Geels, 2004; Quist, 2007).

## **6 Discussion and Remarks**

Even though the method helped the PhD researcher to limit the scope of the literature reviewed and reported in an effective way, the method has some shortcomings related to the risks rising from the selective nature of the process. The primary risk of following a selective process is overlooking a potentially fruitful idea, theory or methodology just because it could not pass the paradigmatic filter. Another risk associated with using a paradigmatic filter could be creating a lock-in around one dominant theory which can pass majority of the filters for being so widespread in the literature due to cross-fertilisation over years. The risk of a lock-in is the possibility of losing some of the diversity of ideas which potentially can lead towards innovative theoretical developments. Both those risks, however, exist with existing, single discipline pathways for literature reviews and, in fact, are reduced automatically in transdisciplinary research due to the broader nature of the disciplines examined. The strategies that were successfully used to further decrease or eliminate these risks in the case study presented were:

- carrying out a very broad preliminary literature review targeting the most recent work in order to have an understanding of cross-disciplinary influences and minor/fringe theories as well as dominant/mainstream;

- continuing and systematic exposure to people and ideas from disciplines other than the researcher is based, and;
- establishing an interdisciplinary supervisory committee.

The method presented in this paper meets the emerging need for a systematic way of reviewing and reporting of literature in transdisciplinary research undertaken by individual, researchers, especially at PhD level. However, even though development of novel methods and tools are essential, facilitating transdisciplinary research also requires institutional changes. A serious and critical look into the structure, content and politics of graduate programs dealing with socially-relevant complex problems is necessary. Therefore, to guide future research in this area some questions are identified:

1. How can the junior researchers be supported in early phases of their research to develop research skills suitable for transdisciplinary research?
2. How can the supervisors of transdisciplinary researchers, who are generally dealing with disciplinary culture and politics of departments/faculties, be supported to provide the most effective supervision for junior researchers?
3. What social and institutional structures can be developed to enable interaction between junior researchers from different departments/faculties in order to encourage transdisciplinary exchange?

## **7 Conclusions**

Ideally and generally transdisciplinary research is undertaken by research groups consisting of experts from different disciplines and stakeholders of the problem needing to be solved. Nevertheless, there are individual researchers who inevitably end-up with transdisciplinary research projects due to the nature of the area they are researching within such as sustainability and/or systems related projects.

Transdisciplinary projects pose unique challenges to individual researchers one of which is the requirement to cover a very wide area of literature effectively. In this paper a novel method for systematic structuring and prioritisation of literature streams is proposed. In this method, the researcher carries out a self-inquiry to identify the vision that he/she would like to contribute in achieving through his/her research. This vision helps the researcher to identify a paradigmatic filter. Further narrowing is done through an iterative process of identifying other filters by inquiring about the mission, context and content of the research and by answering some reflective questions. Guidelines and reflective questions are developed and proposed to help individual researchers to work through the complexity of their own literature review tasks.

This method does not claim to be a fit-for-all fix or an all-time-valid panacea for transdisciplinary research undertaken by individuals. Rather it encourages the researcher to inquire into his/her life vision and capabilities as a way of positioning the research. Ultimately, the method is an attempt to serve during a -hopefully- transitional period towards an academia embracing transdisciplinary praxis.

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