Application of "Theory of Change" in trans-disciplinary research at Lap Giai Domestic Wood Company, Ben Cat District, Binh Duong Province

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ABSTRACT

This article is the results of the project "Assessment of health and safety risks for wood industry workers researched at Lap Giai Company, Ben Cat district, Binh Duong province". Theory of change (ToC) is an intervention strategy to reduce worker health risk and safety that was initially established by the research team before being deployed at Lap Giai Company.

Preparation ToC helps promote and cooperate in the co-production of knowledge between the academic and management group. The paper is a summary of 10 steps of the ToC method, in which, planning, analyzing change needs, projecting impacts, mapping intermediate results, determining project outputs, identifying assumptions, creating diagrams and explaining the ToC are important steps.

The experiences drawn from the theory of change in transdisciplinary study are (1) can be applied to digital transformation research and environmental management research in enterprises. (2) Role leadership is decisive in developing transdisciplinary topics in enterprises. (3) Both internal and external environments must be considered to design the most beneficial change interventions.

Keywords: climate change, disaster risk, drought, flood, saltwater intrusion and river bank erosion

1. Introduction

In 2019, Thu Dau Mot University organized a training course for scientists on trans-disciplinary approaches. The policy of developing a trans - disciplinary research

approach is very suitable for many training disciplines in the university because of its scientific and practical nature, and this is a research approach that helps to overcome the disadvantages of a single-disciplinary approach, interdisciplinary and even multidisciplinary are research results that are difficult or rarely put into practice.

Trans-disciplinary is an approach developed many years ago. Several materials also as hand book have published as: Gertrude Hirsch Hadorn et al. (2008); Penny Urquhart et al (2014); Sabine Hoffmann (2016), Sabine Hoffmann and Janet Hering (2017); Jerzy Pokojski, et al. (2020), Sue McGregor (2020) [6]; C Hernandez-Aguilar et al. (2020); Gül Özerol et al. (2018), Gül Özerol et al. (2018).
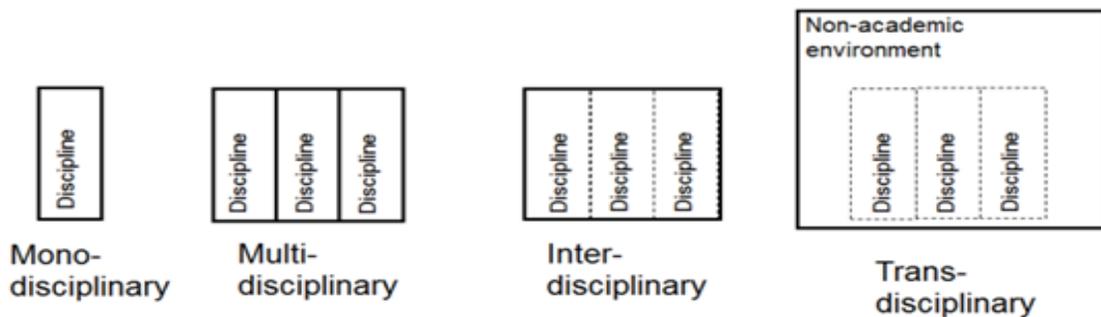
Figure 1: Distinguishing mono-, multi-, inter- and transdisciplinary research (Regeer et al., 2013)

The wood product s of industrial manufacturing include many machines for sawing, planing, milling, drilling, turning, etc. There are many mechanical hazards for workers because they cannot be fully automated. The wood industry also uses a large amount of solvents and chemicals for the purpose of wood surface treatment against termites, spray painting, wood grafting... These chemicals are also potential hazards to impact on the body health of employers

In order to promptly detect, prevent and manage health risks and reduce negative consequences to employees' health, it is an issue that has economic significance for bosses and humanity for employees and workers.

The target of the research results is that solutions to reduce risks for employees need theparticipation of themselves and company leaders, thus the trans-disciplinary research approach when implementing the project is required.

2. Research methods

Approach methods- Differences between interdisciplinary and transdisciplinary approach

The study is carried out in a trans-disciplinary approach, using a variety of collaborative research tools, in which the ToC is applied in preparing the research project. In this paper,

the author wants to share his experience of building ToC when intervening in Lap Giai Co., Ltd. to offer solutions to reduce risks for employees according to the project's objectives.
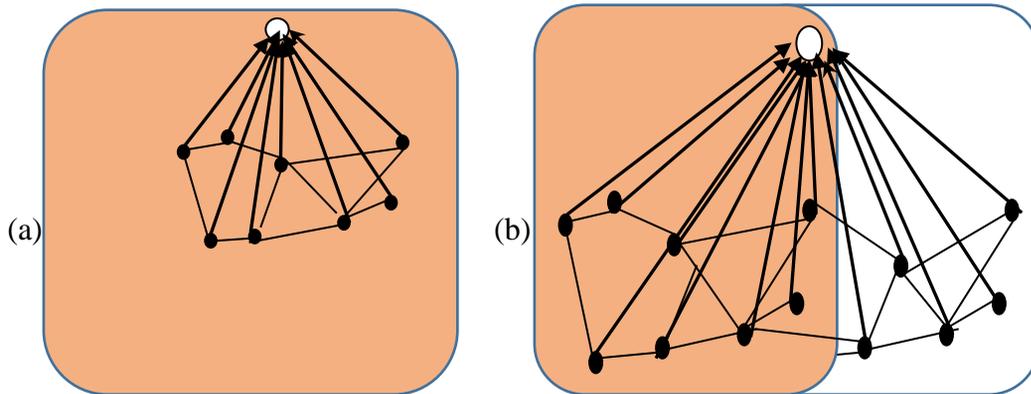
(a) Interdisciplinary approach	*(b) Trans-disciplinary research approach*
Across industry boundaries	Crossing the boundaries of science disciplines and divisions
Develop integrative knowledge	Define common goals
	Developing integrated knowledge for science and for society

Figure 2: Difference between Interdisciplinary and Trans-disciplinary research approach is the participation of non-academic components to get objective of a project (OECD, 2020)

To be more specific, the difference between the trans-disciplinary approach and the traditional interdisciplinary approach is that: The interdisciplinary approach often comes from academic thinking, the researcher collects, analyzes data, discusses and presents intervention solutions. By doing so, the solution may or may not be consistent with reality, or the intervention solution may not be accepted by workers or leaders. On the other hand, beside academic actors, the trans-disciplinary approach involves management, thus overcoming the limitations in results of the interdisciplinary approach.

Theory of change (ToC) has been used as a primary tool in transdisciplinary research. Several publications has introduced guidelines for ToC as Kigali Rwanda (2014); Patricia Rogers (2014); United Way, Greater Richmond, and Petersburg (2016); Derek Armitage et al. (2019); Rasha Al-Akkad (2019); My M. Sellberg et al. (2021)… In order to prepare to conduct research in a trans-disciplinary approach, before coordinating with the management sit es, the research team must outline a strategy to intervene in the industrial system, map out the outcome spaces Scnat Knowledge (2020) as a basis to discuss and knowledge co-produce with the management team.

Thus, first of all, the ToC can be understood as the anticipation of intervention solutions through the process of integrating academic knowledge, with the participation of a whole research team with many different specialties.

Methods of information collection

To develop ToC for the project, the academic team has used in combination with others tools such as Problem Tree, Objective tree (Solution tree); Causal Effect Diagram and collected data also as information from Lap Giai Domestic Wood Company, Ben Cat District, Binh Duong Province.

3. Results and discussion

The results related to the theory of expected change at Lap Giai Company include two parts: a summary of the methods to be shared with readers and a summary of the results on the intervention strategy.

3.1 Summary of Theory of Change methods

Theory of change is a comprehensive representation of the way in which a researcher wants to create a desired change in a particular context.

In other words, a theory of change outlines the steps to be taken so that with the participation of stakeholders in a research project (input) along with the conditions (assumptions) for implementing the project. The trans-disciplinary research team will be able to carry out activities, generate outputs, and these outputs will bring out the outcomes as set out the results. This result will have variable impacts in the research object... Patricia Rogers (2014).

A change theory or change logic model might include the following steps:

3.1.1.Make a plan for the research project implementation

When setting up the ToC, we also need to determine: (1) How much time do we have to implement the research project (that is, the intervention process creates change); (2) How much work you want to do directly (eg, through a workshop or meeting and referencing documents); (3) If you and your colleagues do not have in-depth about Theory of change, an outside consultant can be consulted. We need to support them with information and help them grasp the problem.

3.1.2. Analyzing on demand and context of company

The ToC needs to be rooted in a clear understanding of the problem you want to solve. You will need to collect four main proofs; (1) proof of necessity. This will help you understand why your intervention is needed and the specific requirements of the beneficiary. It is best to perform a "Problem tree Analysis" (2) evidence of the context

of the project includes analysis of 6W: why, what, where, when, who, which; (3) facilitators available to help, regarding other internal and external factors that may affect your work; (4) evidence of the effectiveness of other interventions (this can be interventions you have tried before or interventions that others have done). That evidence will help us decide on a particular way of doing things that is most likely to bring about the kind of change you want to see.

3.1.3. Determine intended intervention

It is necessary to show the final destination, that is, to indicate the expected impact of the change on the subject of the study. Impact is the goal of the ToC, the goal towards which everything is directed. Your impact statement should clearly describe the broad or long-term change you want to see happen. If you have a deep understanding of the needs of your beneficiaries (see step 2), you have a better chance of identifying impacts that reflect what they want to change in their work or life, and /or replicate the result.

3.1.4. Determine the compatibility of your intended impact with the local or higher level

We can think about the impact of the project in line with the strategic priorities of the company, the local or the sponsorship programs, which we can place our work in the broad context i.e. Outcomes must serve Objectives and Goals of higher level. For example, we must choose a study with an impact on the profit goal of the business in two ways: creating added value in revenue, or creating cost savings for the environment, electricity, and water.

3.1.5. Define your long-term results

We will work against your impact to think about the changes that need to happen in order to achieve it. These are sometimes called "conditions" – in other words, things that need to be changed first in order for a lasting impact to happen.

For example, in order for the factory or the wood industry to produce safely, it requires the safety of each workshop and each field. You can identify these by thinking about the root cause of the main problem you're trying to solve in your work. Fishbone diagrams, problem trees, and error trees can be used. If you have more than one target group, you need lasting results for each target group. Try not to have more than four long-term outcomes because if there are too many goals, the theory of change can become too complicated.

3.1.6. Make a diagram of intermediate results in the research process

Next, work backwards and draw the previous stages in more detail. We will need to consider what changes need to happen before lasting results can occur. There will also be other changes that need to happen before these results can occur. Once you have determined your results, you can display the order in which they will occur. For each outcome, think about what changes will be needed before it can happen, and if and how

it relates to other changes. It's generally best to work backwards. However, if you are describing an intervention that already exists, you can combine working backwards from the impact and working forward from the work you already do. WE can combine problem and objective trees (Problem tree => Objective tree).

3.1.7. Determine the output of the research project

Now we're ready to start thinking about what outputs (products, services, or facilities) will help you deliver the results you've identified. For a new job, this will involve thinking creatively about the outputs that will be most effective in delivering your desired results and when they are best delivered. To help do this, you need to look at the outcomes we hope to happen through our work, then look at outside research to see what kinds of outcomes have yielded those results. this in the past (see more in step 2).

At this point, it's also helpful to discover which outcomes your work directly contributes to and which outcomes fall outside the scope of your work.

Remember that some outputs will involve cooperation with other agencies and some outcomes can only be achieved if other services are involved in some way, so the contacts or these joint activities will need to be charted as part of your ToC.

3.1.8. Clarifying assumptions (conditions)

Any ToC is rooted in assumptions. Assumptions are the conditions required for the ToC to work. Assumptions that explain the logic behind the overall program and behind causal links (for example, showing that one output will lead to one outcome, or that one outcome will lead to another). In the ToC, the assumptions are often not well-defined – (if they are so obvious there is no need to mention them.)

Exploring assumptions is important: they can influence how successful an intervention is and may need to shape how you implement the intervention or are tested in your assessment – or both.

Possible assumptions are about: (1) connections between inputs and outputs, outputs and outcomes, outcomes and effects (2) links from one outcome to the next; (3) the quality and scope of your intervention; (4) the role of other collaborators; (5) overall theoretical basis of the project. Once you've outlined your ToC (steps 2 to 6 above), you can reflect on the assumptions that underpin it.

3.1.9. Define resource plan and implementation schedule

Write timelines in your accompanying notes to know when you expect to see activities and outputs happen. (Use Gantt chart). This will shape stakeholder expectations about what can be achieved through the intervention. It will also help you plan when to collect data.

Thinking through our output delivery will help us to plan the resources needed and

budget for the intervention. Remember to make assumptions about the number of people on the team and the time required or, the skills needed and available to you to implement the intervention. As you evaluate, one question to consider: whether appropriate resources have been planned and delivered.

3.1.10. Set up diagrams and explanations for ToC

Present the ToC as block diagrams or easy-to-view formats. Use diagrams and mind maps to illustrate and facilitate trans - disciplinary group discussions. In addition to diagrams, ToCs [H1] need to be more comprehensively explained, and described in theory, because diagrams can be difficult to understand on their own (especially for those who have not been involved in their development for a long time after you create them).

The Theory of Change narrative should include: (1) a description of the process by which the T0C was developed (and who was involved, and how the ToC was conceived) (6W); (2) description of the expected impact; (3) a summary of the need and context for the intervention; (4) describe the results that lead to the impact; (5) describe outputs - how your work will yield expected results (you can also mention inputs - human, physical or financial - here);(6) a description of how you will work with other collaborators; (7) references to timelines - when you think things will happen; (8) a description of the key assumptions and how you will measure them; (9) link to your monitoring and evaluation framework, if applicable.

In short, a theory of change should be a "living" document - it should be revisited as new evidence emerges or as you develop new ways of working. Evaluations can help provide evidence of whether your theory of change is working, and also suggest where your theory needs to be revised.

3.2. Experiences resulted from the research project at Lap Giai company, Ben Cat district, Binh Duong province

After receiving the policy of implementing a case study for trans-disciplinary research from Thu Dau Mot University, the director contacted to have the important assumptions of the project that the business owner agreed to cooperate and the need to accept research results.

Next is the application of the "constellation of contributors" tool including faculty members of the school with expertise in environmental management, chemistry, occupational safety (academic group) and collaborators of the [H1] Lap Giai Company. Three stages of activity are planned to co-create knowledge: At school, at the company and at the factory. Initially, there are four expected outputs that the project will bring: occupational safety, chemical safety, health safety and environmental safety.

Corresponding to the output are 4 results are four groups of solutions to have an impact on the company, which is to protect the safety and health of workers and increase business efficiency for the company, which is to reduce accident compensation losses.

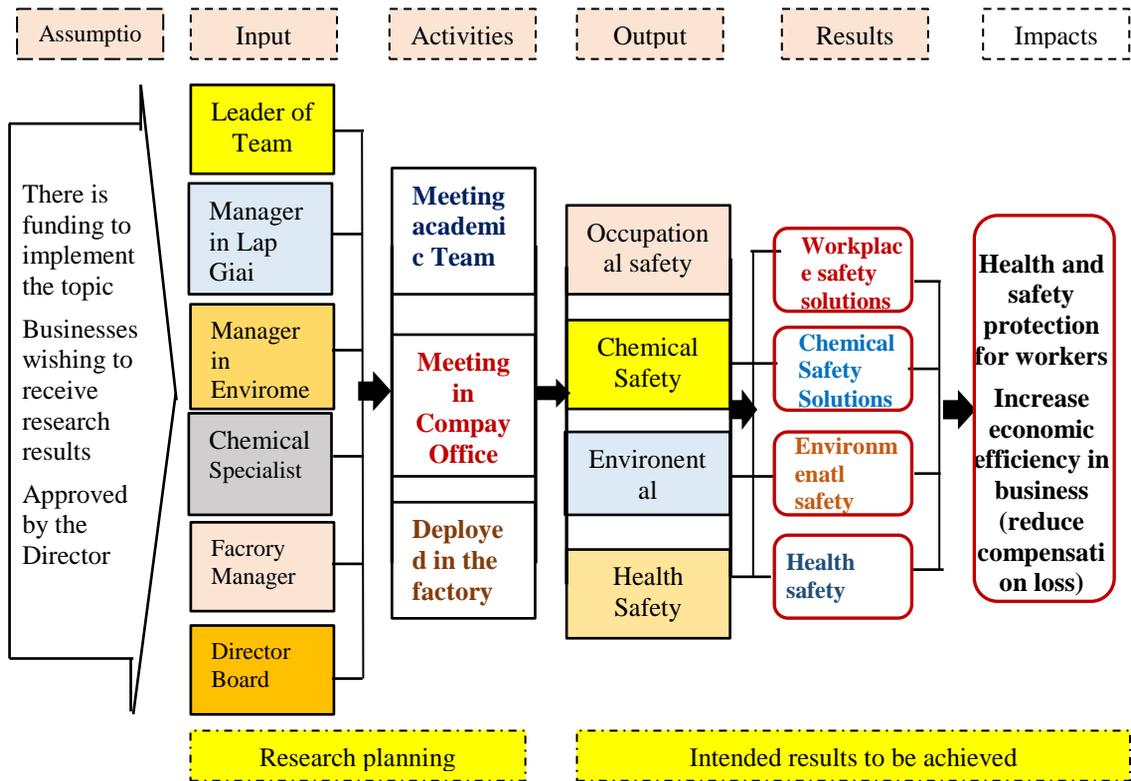*Design the resulting logical model or the theory of change*

Figure 3: Theory of change (ToC) or a logical model of the initial results built by the project leader in project at Lap Giai Company.

The output logic model is another way of saying the theory of change. This model comes from the obvious assumption that:

1. There is funding for implementation (for travel, labor for members, expenses for conferences, etc.)

2. There are enterprises that accept the results of the project and send people to participate.

3. Approved by the top management of the enterprise (Director Board)

Right from the beginning, the goal of the project is to protect the health, safety and environment for Lap Giai company. However, there is a combined goal of reducing compensation and loss costs, reducing production interruptions, thereby increasing business efficiency for enterprises. Although it is a combined goal, it has the effect of persuading the approval of leaders and assigning participants.

When designing the ToC, the project is expected to have 4 groups of resulting solutions: occupational safety, chemical safety, environmental safety and health safety. In order to have the results of solutions, it is necessary to analyze the causes of incidents and accidents.

To have these outputs, it is necessary to have the opinions and co-production of knowledge from scientists with different expertise: environmental management, environmental health and safety management, and staff knowledgeable about chemistry. Studies (types, preservatives):

List of experts participating in the research project is Che Dinh Ly (Project leader); Nguyen Hien Than (Environmental Management); Le thi Pho (Environmental Chemistry); Nguyen Huynh Anh Tuyet (Environmental Management).

Box 1: Summary of minutes of knowledge co-production conversations of scientific staff

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Meeting date: June 15, 2020

Assoc. Prof. Dr. Che Dinh Ly chaired the trans-disciplinary research project, presented ideas on the proposal approved by the Council, detailed the logic of the change model that will be applied to Lap Giai company.

The basic idea of the solution model for 4 areas:

1) Workplace safety solutions when manipulating wood sawing

2) Solutions to avoid industrial diseases from dust and noise

3) Solutions for fire safety, occupational safety and health

4) Safe solution when using preservatives or wood paint

After listening to the presentation and analysis of information about the workshops at Lap Giai company, the scientific staff all agreed with the opinion that the project will try to intervene to change to improve safety and environmental health for employees. Instructors with expertise in environmental management combined with lecturers with expertise in HSE management will analyze the Fault Tree - Event Tree and build a health and environmental safety management model for 4 types of related incidents mentioned above.

Chemical trainers will provide materials on chemicals used in the wood industry and safety measures.

The group of scientists also gave suggestions to the project leader on the collection of state legal documents on occupational safety, chemical safety, occupational safety and health... before working with the [H1] Lap Giai company to increase the persuasion and make it easier for the Company to accept the implementation of change solutions at the factories of Lap Giai.

3.3. Difficulties and advantages when implementing experimental research at Lap Giai

Advantages

Topics that can be applied to a trans-disciplinary approach in the industrial environment are often combined with compliance with government policies/laws and are easily accepted by business partners when implementing projects. For example, the areas of environmental safety, occupational safety, and health for workers are often associated with policies/legal regulations.

Often the problems raised are directly and indirectly beneficial to the business, so it is easy to get the support of the business. For example, topics and projects related to management improvement, cleaner production practices, pollution prevention.

(3) Academic knowledge of the process and solution often has many instructions, only adjusted to suit each business. For example, several environmental health and safety issues have many consulting firms providing services. They advertise so researchers can easily grasp information about production processes.

4) The topics are often associated with business needs in the case of knowledgeable company and factory leaders. They are very willing to support and help and facilitate the implementation of cross-sectoral projects because they understand that they are part of the research and the results they will enjoy.

(5) The implementation of topics related to tribute production enterprises such as environmental health and safety, cleaner production, there have been many summary documents and guidebooks that are very convenient for researchers to assist.

Difficulties:

(1) Due to the economic and management environment, managers often do not have time, it is difficult for them to take the time to discuss with "academic" experts. They are often assigned to deputy or technical staff. In addition to time reasons, another difficulty is that their professional knowledge is also limited. At that point, the researcher should immediately require them the milestones that require their decision.

(2) Discussion issues of co-production of knowledge, implemented in the field, are difficult to argue because managers or workers have to take care of production and practical opinions are often briefly exchanged at the workshop.

(3) The third difficulty is that the changes proposed by the project are agreed upon by the parties and are only expected from the factory manager. If they are positive and have a good perception, it is very fast. On the contrary, it is very slow to be implemented.

(4) Another difficulty when implementing in the industrial environment is that changes in protected areas or management measures are often slow to implement because they

have to go through the approval process of the company's management or factory.

(5) Topics in the direction of cleaner production such as saving electricity and water, and improving management often bring about big changes in economic efficiency. Safety topics must be convincing because businesses have to spend on investments such as labor protection, waste treatment...so businesses often pay little attention to implementation. The mentality of business managers is that when "water comes, they will jump", that is, when they are pressured to check the compliance of government agencies, they do it.

3.4. Lessons learned on building the theory of change in research in a transdisciplinary approach

Through participation in the trans-disciplinary research group of Thu Dau Mot University, chaired the experimental topic: "Assessment of health and safety risks for wood industry workers, researched at Lap Giai Company, Ben Cat province, province. Binh Duong", can draw lessons from -disciplinary scientific research in the industrial environment:

(1) Objects of research in the industrial environment are mostly manufacturing enterprises. The goal of business is profit. Therefore, the topic of research and development in the enterprise must be the subject that the results of the enterprise will benefit. Therefore, when designing projects in an industrial environment, it is necessary to follow two directions: increase revenue and profit and save and minimize costs.

1. The first direction is the direction of innovation (Innovation), increasing revenue and profit: may include topics of innovation, technological improvement to increase the competitiveness of products. In addition, the topics of digitizing management and improving the competitiveness of enterprises are often welcomed.

2. The second direction is the direction of improvement: health and safety management, improved management of cleaner production and pollution prevention, saving electricity, water, and production. Zero emission, recycling, reuse.

(2) Enterprise production is a process that rarely stops. Enterprises must produce continuously. Therefore, the collection of background information, basic information for solutions often has many obstacles. For example, production workshops often lack statistical information such as electricity, water consumption... Therefore, when collecting information, it is often done indirectly through the common monthly bill of the whole enterprise.

(3) Deploying the topic in an operating enterprise requires the approval of the person who has decision-making power in the enterprise. Therefore, the negotiation and persuasion of the enterprise's managers will decide whether the topic can be deployed, especially if it is facilitated to work with production workshops.

(4) In order to get the approval of business management, the researcher must think about the effects the results will bring to the enterprise in terms of competitiveness improvement, revenue, economic efficiency. … Those factors must be explained seriously, specifically and convincingly. If so, the researcher will be more likely to receive the support of the company's leadership.

(5) Before starting to design the topic, design the "theory of change", the researcher needs to understand the internal environment including the factors of resources, knowledge, skills and activities of the organization and its people. The trans--industry group will later be formed on the basis of understanding the inner foundation of the business.

(6) When developing the research topic, the researcher needs to understand the industry environment in which he will intervene in terms of customers, competitors, partnerships, supply chains, technological innovation, etc. and understand the macro environment, indicating the strategy to reach for the business. Such practical knowledge has great persuasive value for businessmen.

4. Conclusions

Theory of change is an effective method that helps the research team to prepare a space of expected results and beneficial effects on businesses. preparation will have the effect of promoting and cooperating in the process of knowledge co-production between the academic and the management team. To implement ToC, you should follow 10 implementation steps, in which; planning, analyzing change needs, projecting impacts, mapping intermediate results, determining project outputs, identifying assumptions, creating diagrams and explaining the ToC are the important steps.

The ToC method should be used in combination with other tools such as: Problem tree, Objective tree, Causal Effect Diagram and so on.

The experiences drawn from the theory of change in transdisciplinary research are (1) Can be applied to digital transformation research and environmental management research in enterprises. (2) Role leadership is decisive in developing transdisciplinary topics in enterprises. (3) Internal and external environments must be considered to design the most beneficial change interventions

References

B. Regeer et al. (2013). *Proposing a fifth generation of knowledge management for development: investigating convergence between knowledge management for development and transdisciplinary research.*

C Hernandez-Aguilar et al (2020). *Evolution and characteristics of the transdisciplinary perspective   in research: a literature review*.

Derek Armitage et al. (2019). *Applying [H1] a "theory of change" process to facilitate transdisciplinary sustainability education*.

Gertrude Hirsch Hadorn et al (2008). *Handbook of Transdisciplinary Research*. Springer.

Gül Özerol, Juliane Schillinger, and Maher Abu-Madi (2018). *Transdisciplinary Research and Development Cooperation: Insights from the First Phase of the Palestinian-Dutch Academic Cooperation Programme on Water*.

Jerzy Pokojski, et al (2020)., *Transdisciplinary Engineering for Complex Socio-technical Systems – Real-life Applications*. IOS Press Ebooks.

Kigali Rwanda (2014). *Theory [H1] of Change*.

My M. Sellberg et al. (2021). *Towards [H1] a caring transdisciplinary research practice: navigating science, society and self*.

OECD (2020). *Addressing Societal Challenges Using Transdisciplinary Research*.

Patricia Rogers (2014). *Theory [H2] of Change*.

Penny Urquhart et al (2014). *Knowledge Co-production Framework*. SARUA.

Rasha Al-Akkad (2019). *Theory of Change Training*.

Sabine Hoffmann (2016). *Transdisciplinary Knowledge Integration within Large Research Programs*. Available from: http://creativecommons.org/licenses/by/3.0.

Sabine Hoffmann , C.P. , [H1] and Janet G. Hering (2017). *Methods and procedures of transdisciplinary knowledge integration: empirical insights from four thematic synthesis processes*. Ecology and Society, Vol 22.

Scnat Knowledge (2020). *Outcome spaces framework*; Available from: https://naturalsciences.ch/co-producing-knowledge-explained/methods/td-net_toolbox/outcome_spaces_framework.

Sue L.T. McGregor (2020). *The Nature of Transdisciplinary Research and Practice*.

United Way, Greater Richmond, and Petersburg (2016). *A Guide to Developing an Outcome Logic Model and Measurement Plan*.