Motivations to Participate in Transdisciplinary COVID-19 Projects

Jana SAJDAKOVA[1], Linda NEWNES, Emily CAREY and Vimal DHOKIA
Mechanical Engineering, University of Bath, UK

Abstract. Transdisciplinary projects claim to be driven by societal needs and hence it would be expected that motivations are driven by the societal and project beneficiaries. Projects conducted in respect of COVID-19 instinctively meet transdisciplinary status with societal benefit being paramount. This paper presents an analysis of six transdisciplinary COVID-19 projects, assessing the motivations of twenty-nine participants involved. Primary data was collated through semi-structured individual interviews and thematic analysis was used to evaluate the reasons for individual participation. The findings show that of the motivations for participation, ethical motivation was 16%, personal fulfilment was 21% and being able to help was 19%. The extrinsic motivations such as expected rewards and benefits was still present but remained very low at 6%. The qualitative responses from the interviews give an indication that although a societal challenge, the motivations remained more of a personal nature aligning with the societal need.

Keywords. Transdisciplinary engineering, Participation for societal benefit, Motivations, COVID-19, Urgent societal problems

Introduction

Contemporary societal problems such as, tackling climate change, sustainable development and achieving net-zero by 2050 can be highly abstract, ill-defined and complex making them hard goals to achieve in practice. Slow governmental response, combined with lack of clear goals, inadequate and ambiguous strategies [1] further exacerbate the complexities of finding deliverable solutions. Approaches to dealing with such problems transcend traditional disciplinary bounds and require the integration of values and perspectives from a wide range of stakeholders [2-4]. Transdisciplinary (TD) approaches are often argued to offer a new way of working and the highest level of integration to contribute to societal problem solving [3, 5-8].

The coronavirus pandemic that emerged at the beginning of 2020 presented an urgent problem requiring collaboration on global and national levels, with broad stakeholders working towards a common societal purpose. In the UK, the government responded by calling on researchers, industries, and people to support the efforts to tackle the virus [9]. With a clear societal goal and government coordination, there was an overwhelming response to the government's call with businesses switching their productions to manufacture ventilators, personal protective equipment (PPE) and hand sanitisers; and individuals organising in volunteering movements to design open source solutions, make face masks, and to help vulnerable and elderly people [10]. In the context

---

[1] Corresponding Author, Mail: js3444@bath.ac.uk.

of the national lockdown, the closing of all non-essential business and a furlough scheme where people could stay safely at home and avoid infection, many businesses and individuals were highly motivated and willing to risk getting involved.

According to Augsburg [2] in terms of motivation, an individual ethical attitude, a desire to improve society and to contribute to the advancement of the common good is a critical factor in TD. Hence individual motivations, personalities and attitudes are critical to the success of a TD project [11], and is argued to be at least as important as disciplinary expertise or specialization [12]. If we are to better equip people and engineering industries to work in a TD manner to collaborate and solve increasingly complex societal problems, it is critical to understand those drivers to motivate participants in the right way.

The purpose of this study was to establish and understand the motivations driving individuals to engage in solving TD challenges. To answer this question, participants who were voluntarily involved in urgent projects with a clear societal focus, namely COVID-19 projects were interviewed to capture their motivations. The responses have been qualitatively analysed, and the results of this empirical study then compared to the motivations described by Guimaraes et al. [13], who characterised what motivates researchers to engage in interdisciplinary (ID) and TD research.

The rest of the paper is structured as follows: Section 2 outlines relevant background literature related to TD characteristics and the motivators of people that engage in TD research or urgent response projects. An outline of the empirical work, including methods used for collecting and analysing the data are described in section 3. In Section 4 we present the results and a discussion of our findings. This is followed in Section 5 summarising our conclusions and future works.

1. Literature review

Much work had now outlined the TD term since it was first proposed by Jantsch [14], although to date there are different schools of thought: The Nicolescuian and The Zurich School and plurality of definitions still existing [3, 4, 7, 8]. However, it is agreed that TD is the highest level of disciplinarity with the highest level and quality of actor integration involving a range of disciplines, practitioners, and stakeholders to create new knowledge [14, 15]. Jantsch [14] also emphasises the focus for TD being the common good and TD literature highlights this true creation of value for society as a unique differentiating feature [14, 16, 17]. Hence, in TD approach there is an emphasis on team-based, collaborative societally driven projects involving different disciplines, stakeholders, and both practitioners and communities.

The benefits of working in a TD manner are recognised, but the challenge remains in implementing TD in practice [16] as many challenges are raised in the complexities of the teams. Teamworking obstacles are discussed extensively in a range of contexts. Gaziulusoy et al. [18], Frescoln and Arbuckle [19] and Hall et al. [11] identify teamwork challenges linked to collaboration among diverse range of actors, in such a way that enables the generation of shared knowledge. Other challenges include communication and language barriers, cultural differences, methodology differences [4, 18, 19]; geographical locations of participants, conflicting goals among teams, and team formation [5]. This type of work is challenging and requires training for collaboration and knowledge sharing, combined with intrinsic personal characteristics like motivation to pursue [20].

1.1. Motivations for engaging in TD

With strong emphasis on creating societal value, in terms of individual's motivations TD assumes strong ethical drivers and a desire to improve society [2, 6]. Ausburg [2], differentiates intrinsic and extrinsic motivations, where intrinsic motivators relate to a desire to engage with real-world problems and crises requiring solutions beyond traditional disciplines. Extrinsic motivations relate to an expected benefit or reward, which according to Guimaraes et al. [13] is not a common motivator for ID and TD researchers.

However, little in the literature exists specifically about what characteristics or motivators are present for people working in TD projects. To best of our knowledge there are only a few studies focusing on understanding the characteristics of individuals identifying as TD researchers [2, 20]. More recently, Guimaraes et al. [13] in the qualitative study of characteristics of ID and TD researchers examines the drivers to engage in work across disciplinary boundaries, and the abilities and attitudes that these researchers possess. They characterise ID, TD researchers as "personalities with a particular mix of motivations, attitudes, skills, and behaviours". It is these characteristics that are of interest to support motivating participation in future TD projects.

1.2. Motivations for engaging in emergencies

In context of the COVID-19 studies it is important to recognise the urgency and emergency state of the situation presented by the pandemic, hence it is highly relevant to also examine motivations for engaging in emergency situations. An emergency can be defined as a real or imminent event which endangers or threatens human life, thus necessitating unusual responses. In emergencies situations like epidemics, members of the injured or the threatened community are the object for rescuing, and volunteers who take part in the event contribute to reducing the damage caused by the event [21], all posing a TD societal purpose. Kulik et al. [21], differentiates between altruistic-ethical and egoistic-instrumental motivations for volunteering (Table. 1).

Table 1. The motivational drivers for volunteering in emergencies [21].

Motivation	Description
Altruistic-ethical (Based on value system)	Volunteering is based on individual's values
	Social solidarity
Egoistic-instrumental (To satisfy personal needs)	Volunteering to grow and develop psychologically
	Escape from reality
	Volunteering to learn more or to practice unused skills
	Volunteering to get career-related experience

Volunteers can be organised, those who are professionally trained (firefighters, red cross) or spontaneous those who offer to contribute following a disaster. Spontaneous volunteers while possibly having relevant knowledge are not members of an organised group and their motives can be characterised by situational necessity or links to the community. As a result, they are reported to experience a stronger desire to escape from the difficult reality of the emergency compared to organised volunteers [21], thus influencing motivations.

In summary, the literature shows that personal characteristics including motivation are crucial to the success of projects for societal good. TD presupposes ethical drivers the main motivator, without a consensus on the relevance of extrinsic motivators such as reward or benefit. In the context of the pandemic, the motivations linked to urgency and emergency are also relevant. We see increase in research exploring TD individuals, their characteristics and motivation, but the focus is mainly on researchers themselves and studies within an engineering context are lacking, hence the contributions of this paper to address this gap.

2. Method

This work examined what motivated people to get involved in engineering projects meeting TD characteristics. The focus of this work were engineers and other roles within the team, employing semi-structured interviews of 29 individuals participating in projects that emerged in response to the COVID-19 pandemic.

Within this work the retrospective data-collection methods were considered appropriate due to emergency context in which data were collected: influential in this decision was the limitations to meet during COVID-19 pandemic, as well as urgency of the situation with people focussed on solving problems. Hence, the data collection was carried out as soon as possible after the project end. Interviews were selected as an appropriate qualitative data collection method to capture rich and open-ended experiences, interactions and perceptions of team members to understand reasonings for attitudes and opinions, interactions and personal interpretations of experience [22]. The participants were encouraged to tell their own story and describe in their own words how they got involved in the project, what was their role, why they got involved, what was their contribution and what did they learn using semi-structured questions encouraging a narrative to emerge [22]. The interview structure was developed as a list of questions, to prompt the researcher to cover all important topics and themes rather then follow questions prescriptively. At the same time participants were encouraged to cover any topics they deemed important through a narrative, which may highlight interesting and unexpected links.

2.1. Case study selection

To select appropriate cases, the type and quality of cases needs to be considered. In the context of this study to assess suitability Jantsch's [14] conceptualisation was applied, for projects to meet three TD characteristics:

1. Different disciplines need to be included
2. There is a need to involve stakeholders
3. Societal value needs to be considered

In all projects experts from different disciplines including academics, practitioners and stakeholders were collaborating on creating societal value with a clear purpose to protect people from infection. Consequently, the selected COVID-19 projects meet all criteria and are appropriate cases.

2.2. Overview of the projects

The quantity of case studies depends on research aim and approach. Within this study a single case approach advocated by Wolcott [23] was not considered appropriate as it provides a greater depth and understanding of the phenomena. This would not capture a wide breath of motivations experienced across different projects, hence multiple case studies were considered more appropriate approach. This follows Stake [24] recommending between 4-15 cases to provide enough interactions between cases but not overwhelm with too much rich data and interactions. From a list of potential cases, six cases were selected to achieve greater diversity of participants.

The projects were initiated by two organisations University of Bath (UoB) and DataSwift with Table 2 illustrating the purpose and outcome of each of these projects. The UoB project was an initiative to engineer novel solutions for a local stakeholder Royal United Hospitals Bath (RUH) to deal with unmet pandemic needs. After initial engagement with the RUH to identify requirements, shortages and areas where real impact could be made, 5 distinct projects emerged, with people organising around projects in which they could or wanted to contribute. ShareTrace project was a winning idea from a global "Hack from Home" event involving 822 participants and 28 projects to develop ethical technology.

Table 2. Projects by purpose and outcome

Project	Purpose	Outcome
PPE	Produce Face Shields to protect front-line workers from infection	Over 100,000 pieces of Face Shields manufactured and delivered. Designs released fully open source.
Oximeter	Design and manufacture pulse oximeter devices that were in short supply	A functioning device designed and tested, 50 units manufactured and delivered. Hardware and software designs released fully open source.
Cabinet Doors	Design cabinet doors for medical instrument trolleys to minimise time spent on sanitisation between patients	Required number of cabinet doors (8) designed, manufactured and delivered to the RUH
Gowns	Back-engineer and produce medical gown to protect front-line workers from infection	8,000 pieces manufactured and delivered
Dual Ventilation	Test if ventilation of two patients on one ventilation is possible to conduct safely	Concept tested theoretically, air restrictor designed and tested in clinical settings.
ShareTrace	Privacy preserving contact tracing app to allow individuals and companies safely resume activities	Fully functioning privacy preserving app developed and commercialised

A list of potential participants was created in collaboration with the project leads of both organisations. In total 32 people were identified and contacted as potential study participants in UoB projects. In total 8 people were identified and contacted in the ShareTrace project. This study while focusing on engineers' participation, was extended to include other participants in different roles and levels of the project to capture wider perspectives. The list included people with different roles and expertise including designers, business, law, marketing, public engagement and assembly volunteers.

2.3. Approach

Interviews were conducted remotely using university approved virtual platforms namely Teams or Zoom depending on interviewee access to technology and preference. Each interview was audio and video recorded, each lasting between 40 minutes to 1.30 hours, to aid analysis. No time limit was imposed, the interview finished when all questions in the interview guide were covered.

The contents of the virtual interviews were transcribed, and written transcripts of participant responses were coded and qualitatively analysed utilising a combination of tools. Traditional sticky notes, coloured pens and paper combined with NVivo digital data analysis software provided a valid and tested analysis [25]. To ensure that the analytical process is productive and rigorous, a practical six stage process defined by Braun and Clarke [26] was followed (Table 3).

Table 3. Six steps of thematic analysis [26]

	Stages	Description
1	Familiarising yourself with the data	Reading and rereading the data and noting down initial ideas
2	Generating initial codes	Coding interesting features in a systematic fashion across the entire dataset, collating the data relevant to each code
3	Searching for themes	Collating codes into potential theme, gathering all data relevant to each potential theme.
4	Reviewing themes	Checking if the themes work in relation to the coded extracts and the entire dataset.
5	Defining and naming themes	Ongoing analysis to refine the specifics of each theme, and the overall story the analysis tells, generating clear definitions and names for each theme.
6	Producing the report	The final opportunity for analysis. Select vivid, compelling extract examples, final analysis of selected extracts, relating back of analysis to research question and literature, produce a scholarly report of the analysis.

To support understanding what motivated people to get involved we utilised patterns of motivations identified by Guimaraes et al. [13] and listed as motivation M1-M9 in Table 4 to classify the participants responses.

Table 4. Drivers for engaging in ID, TD research [13]

Code	Motivations	Proportion of statements
M1	Ethics	16%
M2	Rewards	6%
M3	Real world problems	12%
M4	Fulfilment (meaning and impact)	21%
M5	Bringing together (bringing communities, disciplines together)	4%
M6	Going beyond disciplines	2%
M7	Being revolutionary	0%
M8	Understanding complex issues	3%
M9	Being reflective, connected and connecting fields	1%
M10	Personal stake, first-hand experience	3%
M11	COVID-19 urgency	8%
M12	Being in position to help. Having skills and expertise to help	19%
M13	Peer pressure	4%

In total 90 statements referring to motivation either explicitly or implicitly were extracted from the entire dataset for analysis. The results of the analysis were collated into potential themes and statements matching patterns identified by Guimaraes et al. [13] were coded into the existing categories. Non-pattern matching statements resulted in the creation of a new category, with four new categories (M10-M13) emerging. Third column in Table 4 indicates the frequency of occurrence of each pattern, out of a total 89 statements collected.

3. Results and discussion

Initially 40 project participants were contacted of which 29 responded to the invite to participate in the study (73% response rate). All 29 interviews were included in the analysis, hence the sample comprised of 29 interviewees. Table 5 illustrates individual examples of participant self-described motivations representing the pattern identified in data.

Table 5. What motivated interviewees to participate in COVID-19 projects

Motivation Code	Sample quotes
M1	So, *it felt almost like a duty of doing it*. You know, *it felt like a duty that if we can, we should. We have the capability and just like it would be wrong not to.*
M2	*I think there's there is an element of ego in there*, I think it would be silly to deny it. *It's you know, you want to be part of the team that really helps to make a difference, you want the rewards that comes from that, and I think there's a non-negligible percentage that was driven by that, certainly for me, and I think probably everyone.*
M3	But in this case *having an impact was an extra motivation because it was having impact on something that it is saving life, which is a different impact from a Formula One car where someone is getting more money than I just don't care about Formula One*. But actually, when I was doing something that had impact on the life of the people was an extra motivation that really pushed me.
M4	*I wanted to do something I can think back the later and think actually yes, I helped. I helped to do something positive.*
M5	…my other motivation is that *I had the connections*. I've been at the university for a long time. I worked in my in my research marketing role. *I worked for academics all across the university so was able to help build some of those bridges between departments that allowed some of the multidisciplinary elements to happen*… *We're developing a strategy at that point around how we were going to better contribute to our local community. This was great way of so doing so…*
M6	… *there were designers, and there were marketing people. There were a business model people like me, the information systems, which is professor Y, you know, health experts, doctors from Cleveland Clinic all engaged in this process. … And professor Y was sort of spearheading it amongst a few other people, bringing those skill sets together.*
M7	-
M8	Literally all universities in the UK we're working on ventilators. *And I didn't think that we will be able to make functioning ventilator within that time frame to get it to production. We might have been able to put one together over that whole period and that one wasn't going to help anyone. …. and I thought the PPE was at that time the best shot we had.*
M9	Started off life as an engineer. *That was my first degree and my master's I I've always felt slightly guilty about leaving that and going into medicine, clinical medicine, and so I've always tried to, you know to give back something in my engineering to medicine and something in my medicine to engineering, and I think I've sort of done that*. So, whenever *the opportunity comes up, I do try and do that*. And I mean this was, this is a project par excellence which was which met some of the strongest of my interests.
M10	*So, perhaps selfishly, I wanted to look after my wife, who is working at the hospital. And her colleagues that I know I was aware have been facing Covid positive patients.*

M11	So, the initial involvement I guess was just out of *a sense of this kind of this really big thing that was rolling towards us and the hospital was not prepared. And we had some skills that and some facilities that would enable us to be there to help them.*
M12	…it's a combination of the fact that *we had expertise that was that was applicable to this particular problem, and in fact, in my Research Centre we have done research in ventilators and another breathing systems in the past. So, it's clearly a good match.*
M13	I don't know if you have heard it from anybody else but *I felt a bit of peer pressure to be honest.*

3.1. Motivations for engaging in COVID-19 projects

Table 5 shows a variety of self-reported motivations for engaging in COVID-19 projects with accounts of personal fulfilment (21%) being the main driver for project engagement. This motivation is grounded in experience and the possibility of making a difference in one's own life or life of others. Motivations like ethics (16%) and desire to solve real world problems (12%) also mentioned by participants, while considered being characteristics of a TD person as described by Augsburg [2], are possibly a typical driver for a majority of engineers. This could be linked to an engineers' desire to solve problems (see example M3). However, motivations such as understanding complex issues (3%), being reflective, connected and connecting fields (1%), bringing together (4%), going beyond disciplines (2%) are linked in literature to core characteristics of a TD person although these statements appear relatively infrequently. It is unsurprising that 8% of statements refer to important COVID-19 pandemic specific drivers such as the urgency and emergency of the situation (see example M10). Every participant recognised the urgency of the situation, a feeling of helplessness or lack of purpose in the interviews even if they did not directly link it as a motivating factor. Having a personal stake or first-hand experience of the situation (3%) was also reported mainly with close family members or friends working as frontline workers in RUH (see example M9). Other participants report initially getting involved because of this direct link to the hospital. This highlights the importance of engaging with stakeholders from affected communities in projects to achieve societal benefits [2, 3, 14, 15]. This finding also corresponds with the findings of Kulik et al. [21] that spontaneous volunteers respond to the necessity of emergency situation, stemming from the direct connections to the community. As a result, they experience a strong desire to contribute to improving the situation [21]. To best of our knowledge the link to emergency situations has not been established in existing TD literature.

In contrast to findings by Guimaraes et al. [13], several participants report extrinsic motivations (6%) being a driver in the context of present study. Augsburg [2] describes extrinsic motivation to include rewards and anticipated benefits, for example for an early career academic it was a benefit of recognition that comes from being part of a team that helps (see example M2). For a supplier a reward in the form of potential future business deals is reported. Even senior academics considered working with a world class academics as a motivating opportunity. This is similar to findings reported by Augsburg [2] on extrinsic motivation being a motivator of TD researchers. However, it does highlight that even in emergency situations and in TD projects, motivations relate to personal reward drivers rather than entirely the societal goal.

An attractiveness to stepping out of the box and being attracted to risk taking activities, described by Augsburg [2] were not found in the context of the present study. Rather a strong emphasis was present even for senior academics and industry positions on an ability to recognise they were in a position to help and had the required skills and

expertise to contribute (see example M11). They spontaneously contributed in response to an urgent situation because they recognised that they have the knowledge required at such a time, as reported by Kulik et al. [21]. It is notable that two participants reported feelings of being peer pressured into taking part (see example M12); describing a feeling of fear of being left behind if they didn't participate, this may be linked more closely to extrinsic motivations.

In summary, participant responses show a much broader range of drivers than expected to engage in societally focused projects, including both intrinsic and extrinsic motivations surprisingly being present. These motivations can be related to both emergency situations as in Kulik et al. [21] and to those typical of TD characteristics in Guimaraes et al.[13] or Augsburg [2]. The results demonstrate the strong and expected emphasis upon ethical motivations likely due to the pandemic and emergency situation. However, a particular finding for these projects is the relative high importance of personal fulfilment and being able to help. Another unexpected finding was that the extrinsic motivations, anticipated benefits and rewards was reported. This questions the presence of these elements in alternative TD projects or how to ensure these motivations can be provided for in TD projects to encourage participation. It is not surprising to find that every participant recognised the urgency of the situation and was an underlying driver for most participants.

4. Conclusions

The research undertaken in this paper has sought to understand the motivations driving individuals to engage in solving TD challenges. A robust qualitative method was developed consisting of semi-structured interviews with individuals who participated in urgent COVID-19 projects. The outputs from this were then thematically analysed. The results show a strong emphasis on personal fulfilment; ethical motivation and being in position to help, having skills and expertise to help. This demonstrates that in projects driven by societal need, motivations remain more of a personal nature. These findings suggest the importance of these motivators and the potential to apply them in TD project proposals to drive participation in solving TD challenges.

A particularly interesting finding of the present study was the presence of extrinsic motivation, as literature has not found this to be consistently prevalent in TD studies. In future work this shoud be explored further as it suggests there is a stronger link to extrinsic motivators for TD working.

The underlying drivers for people to participate in these types of TD projects relate to the emergency nature of the problem being solved and this is demonstrated in the additional motivators we found in our results. This finding highlights the importance of relating TD projects to volunteering in emergencies as this link has not yet been substantiated. It also suggests that the skills and experience profile of engineers should consider those specific to profiles of spontaneous volunteers and the existence of relevant knowledge. Future research needs to focus on evidencing if participants are more willing to adopt TD approaches when there is urgency but cautiously consider positives and negatives of continuously working under pressured or urgent circumstance. This study focuses on participantion in COVID-19 projects and future studies and experiments will seek to examine the applicability of results in different contexts including participants prior experience of discplinary or TD knowledge.

References

[1]   S. Pye, F.G. Li, J. Price, and B. Fais, Achieving net-zero emissions through the reframing of UK national targets in the post-Paris Agreement era. *Nature Energy*, 2017, Vol. 2(3), 17024.
[2]   T. Augsburg, Becoming Transdisciplinary: The Emergence of the Transdisciplinary Individual. *World Futures*, 2014, Vol. 70(3-4), pp. 233-247.
[3]   J.H. Bernstein, Transdisciplinarity: A Review of Its Origins, Development, and Current Issues. *Journal of Research Practice*, 2015. 11(1), R1.
[4]   C. Pohl and G. Hirsch Hadorn, Methodological challenges of transdisciplinary research. *Natures sciences sociétés (Montrouge)*, 2008, Vol. 16(2), pp. 111-121.
[5]   P.E. Norris, M. O'Rourke, A. Mayer, K.E. Halvorsen, Managing the wicked problem of transdisciplinary team formation in socio-ecological systems. *Landscape and Urban Planning*, 2016, 154, pp. 115-122.
[6]   C. Mitchell, D. Cordell, and D. Fam, Beginning at the end: The outcome spaces framework to guide purposive transdisciplinary research. *Futures*, 2015. 65(C): pp. 86-96.
[7]   G. Tejedor, J. Segalàs, and M. Rosas-Casals, Transdisciplinarity in higher education for sustainability: How discourses are approached in engineering education. *Journal of Cleaner Production*, 2018, Vol. 175, pp. 29-37.
[8]   S. Lattanzio, A. Nassehi, G. Parry, L.B. Newnes, Concepts of transdisciplinary engineering: a transdisciplinary landscape, *Int J of Agile Systems and Management*, 2021, Vol. 14, No.2, pp.292 – 312.
[9]   Gov.uk. Coronavirus (COVID-19): Call for businesses to help make NHS ventilators. 2020 [cited 2020 1st May]; Available from: https://www.gov.uk/government/news/production-and-supply-of-ventilators-and-ventilator-components.
[10]   BBC. How factories change production to quickly fight coronavirus. 2021   [cited 2021 1st May]; Available from: https://www.bbc.com/worklife/article/20200413-how-factories-change-production-to-quickly-fight-coronavirus.
[11]   K.L. Hall, et al., The collaboration readiness of transdisciplinary research teams and centers - Findings from the National Cancer Institute's TREC Year-One evaluation study. *American Journal of Preventive Medicine*, 2008, 35(2), pp. S161-S172.
[12]   A. Bruce, et al., Interdisciplinary integration in Europe: the case of the Fifth Framework programme. *Futures : the journal of policy, planning and futures studies*, 2004. 36(4): pp. 457-470.
[13]   M.H. Guimarães, C. Pohl, O. Binac, M.Varanda, Who is doing inter- and transdisciplinary research, and why? An empirical study of motivations, attitudes, skills, and behaviours. *Futures*, 2019, 112, 102441.
[14]   E. Jantsch, Inter- and Transdisciplinary University: A Systems Approach to Education and Innovation. *Policy Sciences*, 1970. 1(4), pp. 403-428.
[15]   D. Stokols, et al., The Ecology of Team Science. Understanding Contextual Influences on Transdisciplinary Collaboration. *American Journal of Preventive Medicine*, 2008, 35(2), pp. S96-S115.
[16]   A. Kharlamov, G. Parry, and L. Newnes. When and where is transdisciplinary engineering applied in projects? A case study. *Advances in Transdisciplinary Engineering*, Vol. 10, 2019, pp. 12-21.
[17]   E. Carey, J. Gopsill, and L. Newnes. Text analysis of transdisciplinary research papers, *Advances in Transdisciplinary Engineering*, 2020, Vol 12, pp. 32-41.
[18]   A.I. Gaziulusoy, et al., Identifying and addressing challenges faced by transdisciplinary research teams in climate change research. *Journal of Cleaner Production*, 2016, Vol. 123, pp. 55-64.
[19]   L.M. Frescoln and J.G. Arbuckle, Changes in perceptions of transdisciplinary science over time. *Futures*, 2015, Vol. 73, pp. 136-150.
[20]   Fam, D.M., T. Smith, and D.A.N.A. Cordell, Being a transdisciplinary researcher: Skills and dispositions fostering competence in transdisciplinary research and practice. In: D. Fam et al. (eds.) *Transdisciplinary research and practice for sustainability outcomes*, Routledge, Abington, 2017, pp. 77-92.
[21]   L. Kulik, L. Arnon, and A. Dolev, Explaining Satisfaction with Volunteering in Emergencies: Comparison Between Organized and Spontaneous Volunteers in Operation Protective Edge, *VOLUNTAS: Int. Journal of Voluntary and Nonprofit Organizations*, 2016, Vol. 27, pp. 1280–1303
[22]   M.N.K. Saunders, P. Lewis and A. Thornhill, *Research methods for business students*, 8th ed.. 2019, Pearson, Harlow.
[23]   H.F. Wolcott, *Transforming Qualitative Data: Description, Analysis, and Interpretation*, Sage Publications, Thousand Oaks, 1994.
[24]   R. Stake, *Multiple Case Study Analysis*, Guilford, New York, 2006.
[25]   C. Maher, M. Hadfield, M. Hutchings, A. de Eyto, Ensuring Rigor in Qualitative Data Analysis: A Design Research Approach to Coding Combining NVivo With Traditional Material Methods. *International journal of Qualitative Methods*, 2018, 17(1), pp. 1-13.
[26]   V. Braun, and V. Clarke, Using thematic analysis in psychology. *Qualitative research in psychology*, 2006, Vol. 3(2), pp. 77-101.