Using Soft System Methodology to Align Community Projects with Sustainability Development in Higher Education Stakeholders' Networks in a Brazilian University

ABSTRACT

The purpose of this paper is to report on the use of the Soft System Methodology (SSM) to enhance the role of Higher Education Institution (HEI) stakeholder's action networks in achieving the Sustainable Development Goals (SDGs). We review the literature on Sustainable Development in HEIs, in particular the role of stakeholder networks for the implementation of SDGs in HEI. We argue that the different perspective of the stakeholders around HEIs and the urge to achieve SDGs adds to the complexity of these tasks. We argue that systems thinking and in particular, methodologies that adhere to systemic thinking can help to make sense and open a way forward. We outline some of the features of SSM as an approach to help make sense of this complexity. CATWOE analysis, a conceptual SSM tool, is applied to a stakeholder's network hosted by a Brazilian university with the purpose of achieving the SDGs as part of the community projects (HEI external engagement). The project involved multiple stakeholders: students, academics, junior and senior administrative staff, community institutions, as well as municipality and/or governments' officials. The project illustrates how some SSM tools can enhance the work of partnership by creating gateways for mutual learning and achieving set goals, by scaling up existing initiatives or catalysing new commitments and actions. Findings of the systemic application suggest that the use of some elements of SSM helps clarify and make sense of the role of the stakeholders and assists in formalising action networks to achieve SDGs.

Keywords: Systems thinking, Soft Systems Methodology, Sustainable Development Goals (SDGs); Sustainability in Higher Educational Institutions; Stakeholder´s network.

1. Introduction

In 2014, at the UN Climate Week in New York, Ban Ki Moon –the then United Nation (UN) Secretary General said: "There is no plan B, because there is no planet B". Whilst this was one of the many calls repeated at international forums to address the current climate crises, for the first time the call was directed at everybody. This important message highlighted the importance that various stakeholders, beyond governments and policy makers, have in making efforts towards securing sustainability and survival of the planet earth (United Nations, 2014).

Subsequently, 193 UN members adopted the new sustainable development agenda – the 2030 Agenda - with 17 Sustainable Development Goals (SDGs) (United Nations, 2015). The agenda is based on the Millennium Development Goals, which aim to reach a global course action to end poverty, promote prosperity and well-being for all, as well as to protect the environment and address climate change.

In line with Ban Ki Moon's call, the relevance of sustainable development (SD) has been also recognised beyond the United Nations' forum and became part of the wider public discourse. The debate has also prompted Higher Education Institutions (HEIs) to recognise their extensive responsibility for promoting SD and to identify relevant actions supporting this aim. Indeed, Vargas et al. (2019, 2021) highlights HEIs as agents of change with the duty of implementing sustainability in a holistic way, by integrating it in all areas of activity, thus linking individual, social and institutional considerations (Castillo et al., 2021). Thus, by seeking this wider engagement, HEIs are more likely to develop a systemic approach to SD issues (Shiel et al., 2016; Trencher et. al., 2014).

HEIs have made considerable progress fostering sustainability since the 1992 Earth Summit, where the strategic Agenda 21 was approved (Ruiz-Mallén & Heras, 2020). The purpose of this agenda was to provide a comprehensive plan of action for the key relevant stakeholders at local, national, and global levels. However, with the 17 SDGs underlying the 2030 Agenda there is a considerable scope to realise this plan by enhancing it with action for people, planet and prosperity (Ferguson & Roofe, 2020). Thus, action networks play an important role in fostering HEIs' promotion of sustainability.

The importance of action networks in providing solutions for sustainable development in the HE sector has been acknowledged by the United Nations in 2012, which presented networks as a guiding tool for HEIs targeting the implementation of SDGs (United Nations, 2020; Aznar Minguet et al., 2014; Vargas et al., 2021). Indeed, working as part of local, regional or international networks, HEIs can better demonstrate their capacity for impact; they can create new alliances, and find new sources of funding amongst other benefits. Most importantly, through action networks HEIs promote a wider behavioural change (Bansal et al., 2012). As a result, numerous networks connecting HEIs have been established. Examples include the network of Australian and Pacific Universities, which was created in 2012 in order to mobilise global scientific and technological expertise towards the promotion of practical resolution of problems for sustainable development (Shulla et al., 2020), or the networks of sustainable campuses created around the world with the intention of teaching, research and practice (Adams et al., 2018; UNESCO-IESALC, 2020). However, it has been recognised that the incorporation of sustainability into the HEIs networks' agenda and its implementation have been very complex, heavily relying on desirable behaviours of all HE stakeholders (UNESCO-IESALC, 2020).

Radinger-Peer & Pflitsch (2017) found that stakeholders were major drivers of institutional change in higher education, with impactful local and national networks. More importantly, stakeholder networks form a set of interdependent actors, who are affected by complex socio-economic issues (Schneider & Sachs, 2017). The complexity also characterises the social-ecological systems thinking's view of stakeholders postulated by Lyon et al. (2020, p.81), according to whom stakeholders are "dynamic actors with multiple, mutable, and sometimes intertwined roles, values and capacities within a system facing an environmental problem". Since stakeholders interact between the networks and have a crucial impact on the organizations such as HEIs through the co-operative pooling of their resources and capabilities (Bridoux and Stoelhorst 2016), it is of utmost importance to better understand how the complexity associated with the stakeholder action networks affects the implementation of SDGs in HE.

Therefore, this paper aims to explore the potential for HE stakeholder networks to drive change towards (and beyond) sustainable development by utilising the Soft System Methodology. In doing so, we attempt to explore the following three research questions:

RQ1: What is the state of art of Action Networks theories as ways to implement the SDGs?

RQ2: What is the role of HEIs and its stakeholder's network in facilitating the implementation of the SDGs?

RQ3: How systemic methodologies, such as Soft System Methodology (SSM), can help to clarify the role of HEIs stakeholder's network actions to achieve the SDGs?

The paper is structured as follows. After the introduction, in Section 2, we discuss the role of HEIs in fostering Sustainable Development in their capacity of facilitating stakeholder action networks. In section 3 we outline the main features of Soft System Methodology (SSM) as a systemic methodology useful to clarify the role of HEIs as drivers of action stakeholders networks to implement SDGs. In section 4, we use the context of community projects based on a Brazilian HEI external engagement to illustrate how SSM can help to unravel the role of the stakeholders in implementing the SDGs. In section 5, we advance some initial conclusions and recommendations drawn from the application. We also provide suggestions for relevant future research avenues.

2. Sustainable Development in Higher Education Institutions and the stakeholders' network

The Higher Education (HE) sector and its institutions (HEIs) carry a significant responsibility to promote sustainability encapsulated within the 17 Sustainable Development Goals (SDGs) established as part of the 2030 Agenda (Castillo Longoria et al., 2021; Décamps et al., 2017; Ferguson & Roofe, 2020; Ruiz-Mallén & Heras, 2020). As part of this responsibility, HEIs have been undertaking various initiatives, including the integration of sustainability issues in their curricula, relevant research and wider outreach activities (Ruiz-Mallén & Heras, 2020). For a partial review of distinctive examples of such initiatives the reader is referred to the sustainability agenda of the University of Ashoka in India (Chakraborty et al., 2021), the University of Florence in Italy (Fissi et al., 2021), the University of A Coruña in Spain (Torrijos et al., 2021) and the Diponegoro University in Indonesia (Budihardjo et al., 2021). A range of sustainable initiatives has also been implemented in HEIs in the Latin America (Leal Filho et

al., 2021). Thus, it is evident that sustainability permeates all dimensions of HEIs. However, due to complex characteristics of the HEIs, creating a wider change towards sustainable development became particularly challenging primarily in the area of teaching. Specifically, fostering sustainable practices through teaching requires the HEIs to address a vast range of social, economic and environmental challenges, which are intertwined and subjected to uncertainty and conflicts of values. Indeed, Leal Filho et al. (2019, p. 286) claims that only through a provision of learners with skills to complex thinking, learning through dialogue and communication, engaging in deep reflection, developing worldview and values' sensitivity, and assessing when activities support or detract from achieving the SDGs as well as other important skills, knowledge and vocational expertise, the implementation of the SDGs can be accelerated.

More crucially, HEIs must work with relevant stakeholders as part of wider stakeholders' networks to support the achievement of the proposed sustainability objectives. To address this important motion, HEIs embraced Environmental Education for Sustainability (henceforth EEFS), which allows activating and/or supporting change at a number of levels, with teachers and students engaged in making the changes (Tilbury, 2004). Specifically, EEFS offers an approach that involves power, politics, participation as well as the involvement of internal and external stakeholders in order to make a change within the institution and to reposition it within the community (Tilbury, 2004). The recognition of stakeholders' role in fostering sustainability is important since the success of the implementation of SDGs in HEIs relies not only on their teaching and research activities, but also on engaging stakeholders in outspread sustainable practices (Gori et al., 2020).

Srivastava et al. (2019) studied the factors that influence internal stakeholders' sustainability practices in HEI, focussing mainly on teachers. They established that academic optimism that allows teachers to develop their identity related to the values, policies and practices of the organization, which, in turn, fosters the internal branding by doing their job well, fulfilling brand promises (delivering students' expectations) and improving institutional practices, plays a key role in promoting sustainability in HE.

In a study by Barber et al. (2011), who also examined internal stakeholders' perception of sustainability education, students of Hospitality Management were found to be more focused on learning about environmental problems, understanding consumer demand, training and education; while teachers were centred on the training and awareness of the next professional

generation (Barber et al., 2011). In addition, the study uncovered that industry professionals carried out more practical environmental actions even though they did not have strong environmental attitudes (Barber et al., 2011), thus emphasizing the importance that not only the internal but also external stakeholders have for achieving behaviour change in HE. This argument is further reiterated by Bautista-Puig & Sanz-Casado (2021), who suggest to complement the commitment of university leaders to sustainability initiatives with a collaboration with national and international networks.

The role that external stakeholders play in achieving sustainability goals in the HE setting has been explored by Castillo Longoria et al. (2021), who examined the integration of different members of university community with a multidisciplinary approach pursuing the development of tools for new products and services to reach the responsible consumption objective (SDG 12) at the University of Zaragoza in Spain. In particular, Castillo Longoria et al. (2021) proposed a co-creation model that entails a collaboration and an active participation among numerous stakeholders. They found that greater participation in the process of sustainable transformation is achieved through networks and inclusion of external stakeholders, and with an increased communication between different stakeholders.

Similar results emerge from the study by Mian et al. (2020), who used SWOT analysis to determine the factors that various (internal and external) stakeholders perceive as drivers to the progression and enactment of Industry 4.0 in HE to achieve sustainability. The examination demonstrated that a successful transition involves university leaders to prioritize and allocate funds and investment projects related to Industry 4.0. In addition, the transition is more likely when students and employees are equipped with relevant knowledge and skills, and when the HEIs invite experts, specialized staff and industry professionals. Indeed, the final condition for sustainability identified by Mian et al. (2020) was a creation of a universities' collaboration with private firms, technology businesses, and outside investors for research projects.

The importance of external and internal stakeholders in promoting sustainable development in HE has been also recognized by Blasco et al. (2021), who identified three factors that influence the performance of the SDGs in public universities in Spain. These factors entail: financing by the regional government for infrastructure and research, with higher financing indicating more commitment to achieving the SDGs; internationality rate measured through the partnerships and agreements with foreign universities, especially related to SDG 3 and SDG 17; and the internet presence of universities, allowing them to promote sustainable practices, especially

SDG 17. Blasco et al. (2021)'s findings point to the top-down approach regarding the influence of stakeholders on the implementation of the SDGs in universities. This result is also consistent with the view gained at Portuguese universities, which considered "teaching the concept of SD, encouraging the research on SD, green and environmentally friendly campuses, as well as cooperation between HEIs and local authorities and civil society, and their commitment to results and actions" important (Aleixo et al., 2017). Nonetheless, Blasco et al. (2021) alike, Aleixo et al. (2017) emphasise the lack of financial resources and the need for appropriate strategies that would permit the universities to focus on funded projects about societal and sustainability issues.

The financial barriers to the stakeholders involvement in sustainable practices in HE were also recognised by Wright (2010), who examined the process of sustainable transformation among the Canadian universities. In line with the findings obtained at Spanish and Portuguese universities, Wright (2010) found that low profitability, lack of resources, less government support, as well as lack of understanding and awareness of the problems/sustainability and individuals' resistance to change constitute important impediments on a way to achieve sustainability in HE. This finding also applies to Latin American universities, where the lack of funding and resources, as well as lack of administrative and university staff support are main challenges to investing in sustainable development (Leal Filho et al., 2021; Cavalcanti -Bandos et al., 2021). Consistently with the latter outcome, Wright (2010) argued that universities could become more sustainable with the retirement of traditional disciplinary thinkers and administrators.

The aforementioned discussion shows that the involvement of HEIs' external and internal stakeholders, which gives way to new ideas and innovations in terms of sustainability, is frequently curbed by financial matters. However, the lack of financial resources is one among numerous barriers that impede stakeholders' involvement in the sustainability agenda in HEIs. Other barriers frequently arise from the complex nature in which stakeholders and their networks operate. Indeed, Ackermann & Eden (2011) highlight some of this complexity by identifying three barriers in the strategic management of stakeholders that may render the process of sustainability transformation ineffective. Among those barriers is an appropriate development of stakeholder management strategies, which requires to determine the timing and manner of intervention as well as the stakeholder's power and interest to influence the direction of the organization. The attributes of interest and power have been extensively

debated in the literature since both affect the stakeholders' intentions to implement SDGs at universities. For instance, Langrafe et al. (2020) established that the alignment of stakeholders' interest in the strategic planning process is necessary to build more fruitful relationships with HEIs.

It is also important to recognise that stakeholders operate as part of networks and as part of this operational processes, a number of elements and features can arise. Indeed, as Ackerman & Eden (2011) assert:

> 'One stakeholder's actions can generate a dynamic of responses across a range of others … depicting these interactions (visually) can surface the formal and informal relationships (underlying) social networks' (Ackermann & Eden, 2011, p.186).

Hence, like specific stakeholders' characteristics can impede the promotion of sustainable practices, so can the particular characteristics of networks. One of these characteristics is centrality. A network becomes vulnerable when one main organisation is characterised by a high centrality. Rowley (2017) introduced different variants of centrality, which affect the power of stakeholders. These variants include: 'degree centrality', where a greater number of relationships within a stakeholder network means more ways to access and influence the network; 'closeness centrality' understood as the ability to access others easier and quicker; 'betweenness centrality' where stakeholders connect different points of the network, have control of information flows and collaborative leadership or political manipulation; and 'network status' that reflects network's prestige and legitimacy (Rowley, 2017). Therefore, unbalanced centrality within a network may lead to its vulnerability reducing the support for sustainable practices of individual stakeholders, including HEIs.

Therefore, a potential avenue to develop the literature on sustainable development in higher education would be to identify and study practices of interest and power in inter- and intra-organisational stakeholders' networks. In order to develop this strand, perhaps studies could focus on examining who are the stakeholders with high centrality in HE networks and what their roles are in terms of supporting organisational change towards the implementation of sustainable development.

Yet, the literature examining the wider impact that various sustainability actions have in HEIs is limited. This is important, since the interest in performance and efficient functionality of the networks in the implementation of the SDGs and sustainability in HEIs calls for a corresponding evaluation of the social effects that the strategies employed by universities led to. In this context, Matta (2012) finds that the theoretical-methodological models have not been

sufficiently developed to assess them. Most studies on sustainability networks are bibliometric and focus on either, the characterization of networks (Bravo et al., 2013; Toscano et al., 2019; Fuentes-Doria et al., 2019), or analyse factors that influence the adoption of sustainability practices in HEIs. (Menzel & Klan, 2014). However, since HEI is a complex system with multiple subsystems that interact and have significant social, political and human components, their examination requires the use of more appropriate tools. The tool that enables appropriate investigation in conditions of complexity, uncertainty and conflict is the Soft Systems Methodology (SSM). This methodology accounts for the alignment of community projects with the SDGs in the action networks, thus improving the role of the HEIs' stakeholder action networks in achieving the SDGs. While the SSM tool has been widely applied in in information systems (Martinez & Rossi, 2008), in processes, strategies and continuous improvement of various production and institutional lines (Martínez, 2015; Mejia et al., 2020; González et al., 2021; Castillo & Osorio, 2011; Adaniya Higa, 2019; Nuñez Amacifuen, 2016), to our knowledge this is a first attempt to apply SSM to the assessment of sustainability networks in the HEIs. Thus, the next section outlines the advantages of using a systemic methodology instead of a reductionistic outlook when dealing with complexity. This discussion is then followed by the introduction of the Soft Systems Methodology, a methodology that helps make sense of a complex situations.

Summarising, the brief literature review presented above demonstrates that HEIs have become aware and continue increasing their awareness of sustainability and the need for networks in the implementation of SDGs. Nonetheless, initiatives and strategies developed in universities have different approaches to sustainability, generating a bias in a holistic development of sustainability practices in HE setting. In addition, there is not a uniform methodology for efficiently implementing all SDGs that would include both the objectives of internal and external stakeholders and the complex relationships between these groups. Thus, it is important to recognise the significant role of formal and informal, as well as internal and external stakeholders' networks, such as governments, national and international organisations and university communities, in fostering sustainable practices in higher education.

3. Reductionism and Systems Thinking: analysis and assessment of stakeholders' networks in HEIs

In this Section, we outline the main premises of reductionism and systems thinking as ways of approaching a phenomenon in the real world. We then sketch the main features of SSM and in particular one of its tools, the CATWOE analysis. CATWOE is an aid for making sense of a complex situation and exploring a system's performance.

Reductionism is the philosophical position that has been instrumental in advancing the scientific method for studying natural sciences. Essentially, *ontological reductionism refers to the '*….belief that the whole of reality consists of a minimal number of entities*'; and methodological reductionism* claims that *'*….the best scientific strategy is to attempt explanation in ever more minute entities*'* , the Oxford Companion to Philosophy (OCP, 1995, p.750).

There is no doubt that this method has been at the success of many scientific achievements. Basically, this position sees the parts as paramount and seeks to identify the parts, understand the parts and, works upwards from an understanding of the parts to an understanding of the whole. But when applied to the social sciences, the problem with this is that the whole often seems to take on a form which is not recognisable from the part: the whole emerges from the interactions between the parts. Moreover, these affect each other through complex networks of relationships.

One can argue that reductionism method exhibits these main features: (a) Logical Thinking; (b) Reduce Total into smaller parts, analysis driven; (c) Casual Thinking (linear thinking) (d) tendency to observe specific situation and try to generalise; and (e) has a tendency to be 'rational' and 'objective'

On the other hand, Holism or Systems Thinking can be defined as a view in which '. . .properties of individual elements in a complex are taken to be determined by the relationship they bear to each other elements'(OCP, 1995, p. 371). Holism considers systems to be more than the sum of their parts. Systems thinking is highly associated with this view in that it aims to tackle problems by examining the context of the systems in which the problem occurs, dealing with wholes rather than parts.

The nature and significance of systems thinking can be explained by the stand of the two different paradigms that are present across management practice. The distinction between the two adjectives *systemic* and *systematic*, that in the English language are related to the noun system, is also crucial to understand the stands of these two different paradigms and the nature of systems thinking in education.

Systems thinking advocates the importance of making a conscious effort to appreciate other people's perspectives. Churchman, described the systems approach both as a process in which one needs to 'sweep in' as many elements and actors affected as possible; and as a process of looking at the situations from different perspectives, indicating that- *"A systems approach begins when first you see the world through the eyes of another"* (Churchman, 1968, p. 231).

In theory, these are the principles underpinning systemic thinking but when we try to apply them, we need to use a methodology to guide the use of these principles. We outline soft systems methodology (SSM) a systemic methodology developed by Peter Checkland (1981, 1999). SSM has been widely used to tackle complexity and to bring improvement in a particular complex, messy situation (Ackoff, 1993, 1995) and possibly to introduce some changes.

3.1 Soft Systems Methodology (SSM): the importance of enquiring about complexity

Peter Checkland's Soft Systems Methodology (SSM) is one of the most developed Systems Methodologies in terms of its theoretical premises and philosophical underpinnings. It is also one of the most widely used in the UK and in other parts of the world (Mingers and Taylor, 1992; Ledington & Donaldson, 1997; Paucar-Caceres et al. 2015; Paucar-Caceres and Jerardino-Wiesenborn, 2019). During the 1970s, Checkland and his colleagues at Lancaster University questioned the use of hard (reductionistic) systems thinking to real-world situations and started to test a new methodology that shifted the *systemicity* from the real world to the process of enquiry itself. In other words, we can use systems to enquire about the real world.
In essence, SSM articulates a learning process which takes the form of an enquiry process in a situation that people are concerned about. This process leads to action in a never-ending learning cycle: once the action is taken, a new situation with new characteristics arises and the learning process starts again. The methodology is summarised in Fig 1. This is the SSM best known methodology and although Checkland has expressed a most flexible way of applying

his ideas in his latest book (Checkland and Scholes, 1990), the 7-stage methodology is still the most convincing and helpful account of the SSM enquiry.

The basic structure of SSM rests on the idea that in order to tackle real-world situations, we need to make sure that the 'real-world' is separated from the 'systems thinking world'. This distinction is crucial for SSM because that assures us that we will not see systems 'out there'; that is in the real world. SSM urges us to consider 'systems' as abstract concepts (preferably, the word 'holons' should be used) which, when applied to the real-world, can eventually help to bring some improvements to the situation concerned.

Broadly speaking, the hard, reductionistic approach follows a positivistic epistemology, whereas SSM follows an interpretive perspective (Checkland, 1981; 1986; Checkland and Scholes 1990; Jackson,1992, 2003). This can be summarised as follows: According to Checkland, the living world is an ever-changing flux of events and ideas and 'managing', essentially means reacting to that flux. We *perceive* the real world by selecting issues of interest; we *predicate* (or model) the relevant issues and, *compare* our perception with the model and we take *action*(s) which itself becomes part of this flux. This leads to further perceptions and evaluations, to more actions and so on. . . It follows that SSM assumes that different actors of the situation will evaluate and perceive this flux differently, thus creating different issues that the manager must address. Here, SSM offers to managers the systems ideas as a helpful tool to tackle problematic situations arising from the issues. The world outside seems highly interconnected, forming wholes. Therefore, it seems that the concept 'system' can help us to cope with the intertwined reality we perceive. Figure 1 shows the basic structure of Soft Systems Methodology.

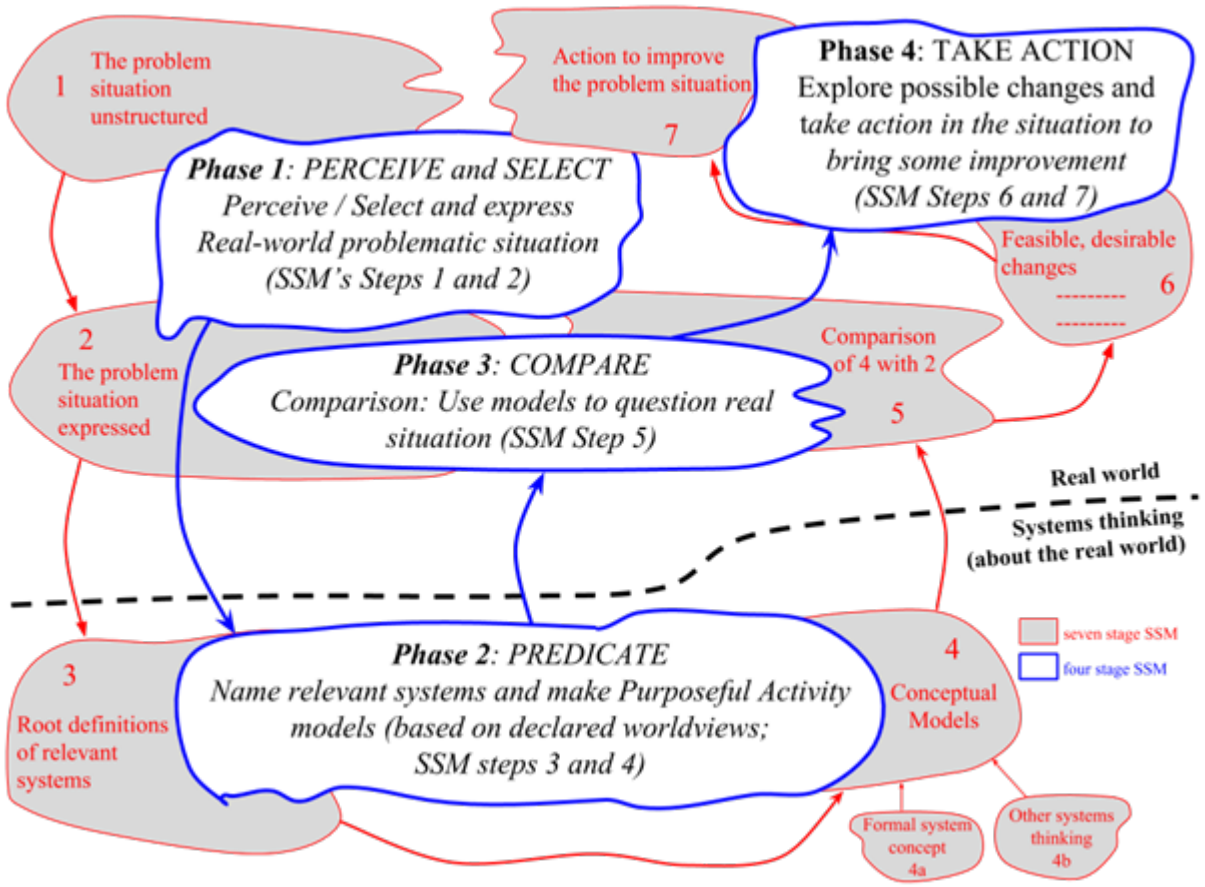

Figure 1. The Basic Structure of Soft Systems Methodology: Four phases (Perceive/Select; Predicate; Compare; and Take Action) and SSM 7 steps/stages (Source: Jerardino-Wiesenborn, *et al* (2019), based on Checkland 1981)

3.2 Making sense and exploring a system's performance: SSM's CATWOE Analysis.

When we face a complex system and try to assess how well it is performing or how it ideally should perform, SSM offers a practical tool based on the analysis of the main elements that are present in a system. CATWOE is the SSM mnemonic of the six crucial characteristics which should be included in a well-formulated root definition of a relevant system, Checkland, 1981, 1999.

C 'Customers' - the beneficiaries or victims of the transformation process

A 'Actors' - those who would undertake the transformation process

T 'Transformation' - the conversion of input to output

W 'Weltanschauung' 'worldview' - the worldview that makes this transformation meaningful

O ‘Owners’ - those who could stop the transformation

E ‘Environmental constraints’ - elements outside the system which are taken as given.

From these elements, T is at the core of any root definition encapsulating the concepts that inputs are transformed into outputs as the root definition suggests.

T, the transformation process, is the CATWOE element on which Checkland elaborates the notion of measuring the performance of the system. According to Checkland, at the most fundamental level, any purposeful activity may be expressed through a Transformation Process which “changes or transforms some input into some output”. In other words, for the *Transformation* to be relevant, Inputs are present in Outputs but in a changed state. Then if the Input is abstract (e.g. ‘need for nursing services’) then the Output must also be abstract (e.g. ‘need met’). If the Input is concrete (e.g. ‘a patient’) then the Output must be concrete (e.g. ‘a treated patient’). This distinction is important because it helps to differentiate between the resources and the inputs of the system. SSM also stresses the fact that there are many ways of expressing a purposeful activity; more ways of expressing the activity in terms of Input-Transformation-Output will enrich the thinking.

According to SSM, when we try to ‘manage’ purposeful ‘systems’, it is useful to think of this situation in terms of:

(a) a purposeful system arranged as a set of activities which we may call the “operational system” (a set of linked activities to do ‘x’).

(b) a set of activities which will inspect the performance of the operational system and eventually will take action to bring it into line with aims and expectations; this is the “monitoring and control” system which monitors and controls the doing of ‘x’.

(c) The system can be thought of as part of a wider system which decides to do ‘x’ (the ‘what’) or decide the way (the ‘how’) in which ‘x’ is carried out; these decisions are carried out by its own “monitoring and control” system which monitors and controls the long term objective of the system located on an upper level. The criteria by which the Transformation can be judged provides the elements by which we can measure the performance of the system.

So, if we think of the two levels expressed above, we should ask the question: **How can the Transformation fail?** For controlling purposes and ultimately, for ‘managing’ this activity, the following reflections and possible answers are useful:

(a) The way chosen to do **T** might not work; therefore, we manage **T** by asking: Does **T** mean selected work? The answer measures the **Efficacy** of **T**, measured by the monitoring and controlling activities at the 'operational system' level.
(b) Is **T** being done with minimum resources (including time)? We manage **T** by asking: Is **T** being done with minimum resources? The answer measures the **Efficiency** of **T**, measured by the monitoring and controlling activities at the 'operational system' level.
(c) **T** could be the wrong choice of activity. We manage **T** by asking: Is **T** the right thing to be doing? The answer measures the **Effectiveness** of the System, measured by the monitoring and controlling activities at the 'planning system' level.

In the next Section, we set out the context of the case study and then proceed to apply the principles outlined above. The case which serves to illustrate the application is a community project currently managed by the Centro Universitário Municipal de Franca-Uni-FACEF, Franca, Sao Paulo, Brazil.

4. Using Soft System Methodology to align external community projects to SDGs at a Brazilian HEI action Network

In this Section, we report on the application of some of the SSM features to a real-world situation in the form of a Brazilian HEI (Franca-Uni-FACEF) trying to manage community projects and, attempting to link outcomes with sustainability development goals.
In Brazil, the Federal Constitution establishes university external engagement as one of the pillars of HEIs in the educational process, it is known as one of the tripods of Brazilian HEIs alongside teaching and research areas. For example, according to Article 207. '. . .Universities shall have didactic, scientific, administrative, financial and property management autonomy and shall comply with the principle of inseparability of teaching, research and extension activities" (Federal Supreme Court, 2020). Therefore, the university external engagement area is a process that needs to be articulated with teaching and research areas with a transformation focus. It presents itself as a "bridge" between the university and the community.

In this Section, we outline the main features posed by these policies and we highlight the ways in which Uni-FACEF, can manage these projects to bring them in line with the UN SDGs for the benefit of the community of Franca.

4.1 External Engagement in Centro Universitário Municipal de Franca-Uni-FACEF, Brazil

As indicated above, the community projects vary in range. They emerge as an answer to a range of societal problems such as: poverty, homeless, lack of opportunities to work, access to education, hunger, gender inequality, domestic violence, malnutrition, antisocial behaviour and lately; the unknown and emergent consequences of the covid pandemic.

Included within the scope of these external engagement activities, Uni-FACEF receives projects with remits along the following lines: social projects, programs, courses and workshops, scientific and cultural academic events, providing services to the community and, support to student associations, among other activities. Thus, external engagement activities need to be articulated vís-a-vís teaching and research areas. This strengthens the university student's learning process, while contributing to the community's participation in university life.

After 2015, with Agenda 2030 and the creation of the 17 Sustainable Development Goals (SDGs), sustainability became a more or less a universal language, which HEIs are expected to utilize. However, the practical integration of teaching, research and extension areas through sustainability became a challenge. The range of universities' extension activities is a vast field encompassing social projects, programs, training courses, workshops or other activities that can be aligned with sustainable development, specifically when these same universities are pursuing stakeholder engagement.

Throughout its 70 years of existence, Uni-FACEF has constantly updated its activities, legitimizing its scientific academic work, training its professionals, and providing quality services to society. We agree that its mission: "To build and spread knowledge, contributing to the formation of human beings, so that they can exercise their role in society with ethics and citizenship" is associated with the sustainability discourse. Specifically, Uni-FACEF's objectives are to:

a) train people with skills both for a high technical-professional performance and for the exercise of citizenship, with an ethical and participative experience in the social world;

b) promote the development of knowledge, its critical transmission and understanding of the current world, particularly with regard to national and regional needs;
c) participate in the development of conditions and actions that demonstrate "learning to learn" and promote continuing education in the fields of professional activity with which they identify;
d) share, with all segments of society, the identification, analysis and search for solutions to the problems of the community, both local and regional, and of the wider society, encourage participation in scientific research, publish and disseminate work at events.

4.2 Community Projects at the Centro Universitário Municipal de Franca: Relevant problems to explore

Community projects are projects proposed mostly by the academic staff themselves or requested by institutions outside the HEI, with specific demands for academic guidance. For example, an NGO working with homeless people needed help from psychology academics and students to support their work. The implementation of these projects constitutes a complex situation, involving several stakeholders with different '*Weltanschauung*' namely: students, academics, department courses, chiefs, HEI staff, HEI senior management, institutions (public, private, NGO), community and governments' officials. In the first instance, the project team felt that there was a need to expand the role of the stakeholders concerned in a complex situation like the one in hand and, to try to focus on their sociological roles. According to Gregory et al. (2020, p. 322) citing Córdoba and Midgley (2006, 2008); Ulrich (1983, 1996) suggests expanding the role of defining the stakeholders by asking a simple question: '. . .who are the stakeholders of this issue?'. Furthermore, using Laplume, et al.(2008), they suggest adding a sociological question in the definition of the stakeholders. This relates to how society is actually affected also, '. . .whose values are currently being considered, and whose values ought to be considered?' (Gregory et al., 2020, p.322). Along these lines, and after a series of conversations with the persons involved, the project team compiled a list of the possible stakeholders and its terms of engagement as can be seen in Table 1.

Stakeholder	Terms of engagement in sustainability development (SD) community projects
Students University students, enrolled in an undergraduate course (applied social sciences, health, engineering, computing, or languages)	• Interested, proactive, but anxious to put the theory into practice. • Learning and seeking engagement with community
Academic Staff Especially research active academics and teaching sustainable development in all UG programmes.	• The academic staff who get involved with social projects see this activity as an excellent opportunity to form groups willing to learn in an interdisciplinary setting. • Learning experience contributes to improve their role and impact on community.
Senior Academic Staff/Programme Leader Department Head (Graduation Course) Leader of the undergraduate courses	• Engagement often starts when university authorities (VCs) approach staff with specific community project.
External Institutions/NGO Community staff or Community institution (private, public, NGO) which see the HEI as a centre for continuous learning and exchange.	• Engagement sought with specific need and looking for a viable solution.
Community Organised / no-organised population, needing a tangible outcome process from the project. Also, individual citizens.	• These see the university as a source of support, and exchange of experiences and problem solving • People who are or are not connected to the institutions, but they are confident in having the university as a support point for social issues.

Table 1. The Community Project's stakeholders and their terms of engagements as perceived by the project team

One of the problems is that most of these projects are not adequately formulated and framed in terms of SDGs even though they attempt to fulfil the tasks of HEIs action networks in its aim to address the SDGs. In other words, there is a need to align the purpose of these projects with sustainability development awareness, amongst the stakeholders themselves. Moreover, we believe that this is where systemic thinking can help. We advocate the use of some of the tools offered by Soft Systems Methodology (SSM). Following the general SSM seven-stage process depicted in Figure 1, SSM starts by structuring the complex situation and one of the initial steps is to draw a Rich Picture in which the project team and the stakeholders try to include all

the points and issues of concern, hard and soft data as well as the perceptions of the people involved. An initial attempt to draw a rich picture (RP) of the situation is depicted in Figure 2. Once the RP was drawn, the project team and some of the stakeholders (in order to make sense of these situations), formulated a number of questions. Some of them were the following:

1. How does the Centro Universitário Municipal de Franca-Uni-FACEF manage (formulate and implement) its external and community engagement?
2. How can the project management at the Centro Universitário Municipal de Franca-Uni-FACEF develop a sustainable community engagement system that can be credible and recognised by the community and society?
3. Is there a way to align the outcomes of the community projects with the SDGs?
4. How can the project management at the Centro Universitário Municipal de Franca-Uni-FACEF encourage the various stakeholders to internalize the language of the SDGs?

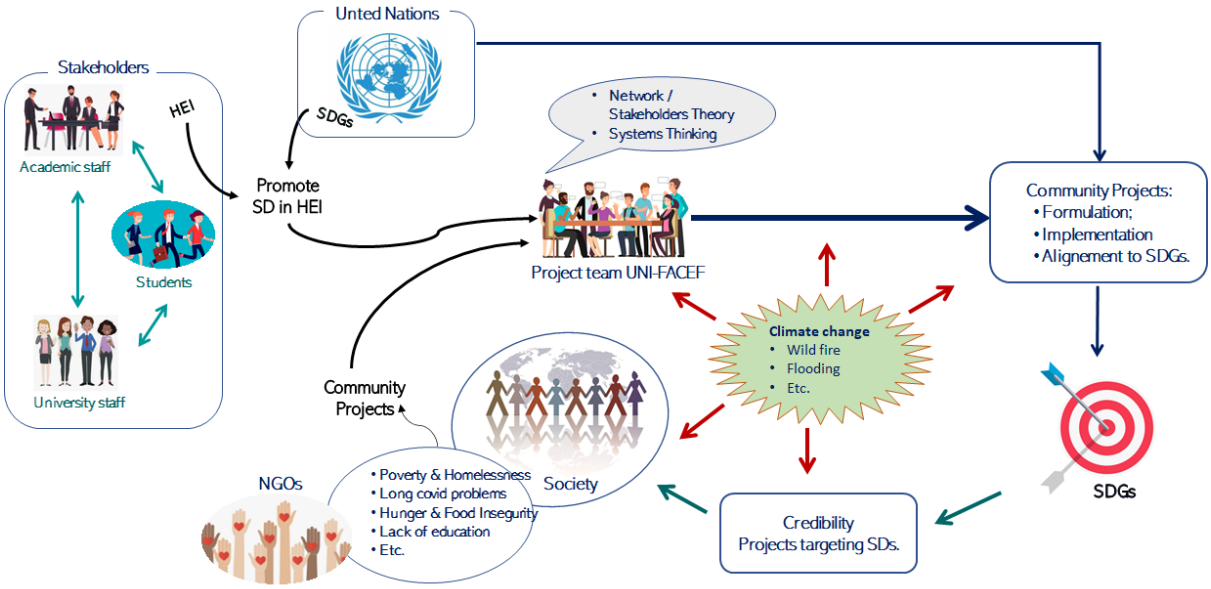

Figure 2: Rich Picture depicting the situation at Uni-FACEF Community Projects

4.3 Aligning the Community Project with SDGs by applying Soft Systems Methodology (SSM) Model SSM and the Transformation Process

Leading on from the four questions that were posed in the previous Section, we will choose one of them as depicting the most pressing issue. This is in order to illustrate the use of the SSM and how we can align external engagement community projects with the SDGs.
Among the issues raised by these questions, it became apparent that one of the most relevant seems to be the one concerning how to align community projects with SDGs goals. This, in turn, will enhance the students and staff awareness of sustainability development and climate change, as well as improve the HEI environmental credibility and credential amongst the community. We can also model this concept using some basic ideas from SSM. The issue is regarding how the project management team adapts ongoing projects to bring them in line with the tenor of SDGs.

These concepts and the different views around issues pertaining to the project team's (at the Uni-FACEF) involvement in external engagement community projects were described using Checkland's Transformation Process. In Table 2, we focus on the issues arising from the first two questions in the previous Section, together with the concepts that are needed. This is in order to draft a model and acquire better understanding about how to manage and monitor it.

Relevant issue and question (from RP)	**Possible Transformation Systems**
• How does the Centro Universitário Municipal de Franca-Uni-FACEF manage (formulate and implement) its external and community engagement?	• A way of aligning current and future projects with the SDGs' tenor
• How can the project management at the Centro Universitário Municipal de Franca-Uni-FACEF develop a sustainable community engagement system that can be credible and recognised by the community and society?	• Ways of seeking recognition and credibility from the community for community projects aligned with SDGs

Table 2. Two relevant issues and systems to model as transformation process using SSM concepts

Using Checkland's model on the question and the views arising from it, we can apply the following control and monitoring concepts to this situation:

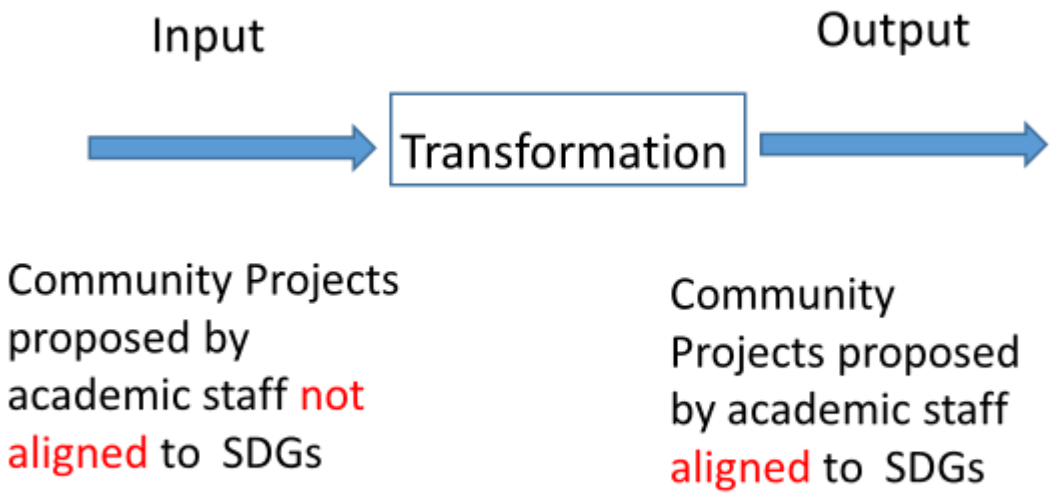

Figure 3. Input and output in a transformation process of Community Projects system

In Figure 3, we have as input: '*projects proposed by academic staff not aligned to SDGs'* and as an output the same kind of input but in a transformed state: '*projects proposed by academic staff align with SDGs'*. Another possible 'T' could be: '*Uni-FACEF community projects committed to SDGs are not recognised by community in general'* and as an output the same kind of input but in a transformed state: '*Uni-FACEF community projects committed to SDGs are recognised by community in general*'. To specify Input and output in these terms, according to SSM is an important distinction. It is also the right way of stating I/O in systems language (as opposed to say- input as 'resources', i.e.: material, money, etc. and as an output: 'result product). SSM insists that the output is just the input but in a transformed state. So, in the diagram above, in order to successfully manage this process we should ask the following questions:

1) Do the means selected to do **T** work? In other words, does the plan to align Community projects with SDGs work? The answer will be a measure of **Efficacy** of **T**.

2) Is **T** being done with minimum resources (including time)? – This is relatively easy to measure (costs associated with making the alignment to happen; this may imply forming a dedicated team to do that and project managing the whole process). This answer measures the **Efficiency** of **T**.
3) Is **T** the right thing to be doing? Here we need to question the need for alignment of community projects with SDGs in the first place. This question can be asked only if we move to the upper level, that is to the planning system. At this level, the planning system may decide to have a 'strategic plan' and indeed to question involvement in the first place; the planning system of this notional system could decide to do 'y' instead of 'x' (to move the need for the community project's alignment to another need). The answer will be a measure of the **Effectiveness** of the **system**.

Managing the series of external engagement in community projects currently faced at Uni-FACEF and the alignment with SDGs is a complex situation. We argue that in this situation, systems thinking helps to clarify the situation and to make sense of the elements and its connections. Looking at the scenario in terms of the three '**Ts**', gives some clarity about what can actually be confirmed. Figure 4 is an attempt to illustrate this and to clarify the way a community proposal can be aligned with SDGs and, how the proposal and performance can be assessed using CATWOE analysis tools from soft system methodology, as indicated in Section 2.

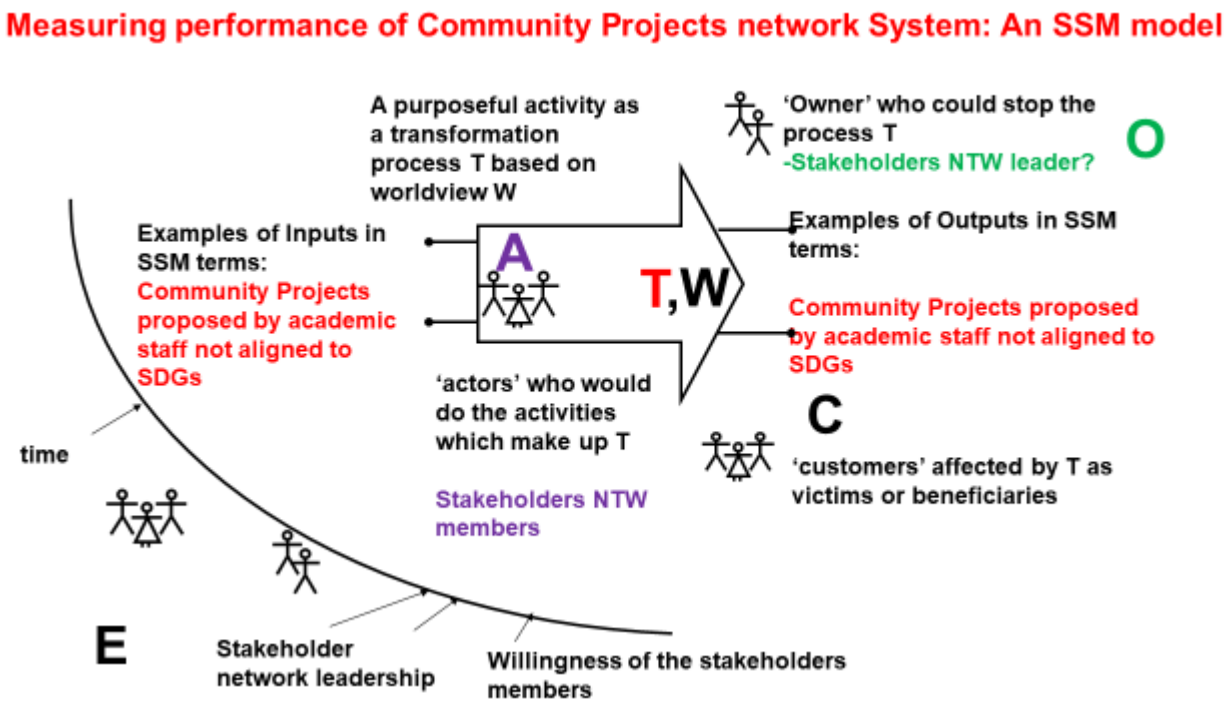

Figure 4. A CATWOE of the community project and SDGs system: an SSM model (adapted from Checkland and Poulter, 2006)

5. Conclusions, final remarks and further research

- This paper contributes to the systems and stakeholders' engagement literature by making the theoretical argument that action networks in HEIs community projects can be enhanced by using systems principles embedded in systemic methodologies such as soft systems methodology (SSM). At a practical level, we reported on the application of some elements of SSM into a real-world community project currently managed by a Brazilian HEI. In this case, the University was concerned with aligning the portfolio of community projects with the sustainable development aims indicated in the SDGs.

- The Paper outlines the potential benefits of systemic thinking over reductionism when facing complexity. In addition, we set out to find and to assess the state of art of Action Networks theories related to ways of implementing the SDGs. This is in addition to the role of HEIs and their stakeholder networks in facilitating the implementation of the SDGs. Our findings suggest that the role of HEIs and their network of stakeholders in facilitating the implementation of the SDGs is to provide students with skills for:

complex thinking despite intricacies, learning through dialogue and communication, developing a *Weltanschauung* and sensitivity to values. In addition, professional knowledge and experience must function as part of a broader rubric including stakeholders; henceforth, EEFS - Environmental Education for Sustainability. This active form of education also recognizes the importance of stakeholder networks in promoting sustainability and becoming the pillar of 'transformational preparedness'.

- The related question to the above theoretical enquiry we sought to answer was to explore how systemic methodologies, such as Soft System Methodology (SSM), can help to clarify the role of HEIs stakeholder's network actions to achieve the SDGs. We have assessed the management of Uni-FACEF external engagement community projects, to illustrate the use of transformation process, measures of performance and CATWOE analysis from soft systems methodology. Uni-FACEF community projects can be proposed by different stakeholders, however it is more common for demand to come from bottom-up source(s), from the academic staff and/or students aligned with their interests. These are seen as the most driven projects. At this time, we can see that as explained by Ackermann & Eden (2011), in the literature review, one stakeholder's actions can generate a dynamic of responses depicting formal and informal relationships from social networks. A general reflection emerging from the exercise was that the SSM proposed measures of performance were useful to clarify how the project's objectives can be aligned with the SDGs set out by the UN.

- Finally, it is worth mentioning that by taking a systemic approach to the community stakeholders' engagement, there is, therefore, an important opportunity for the HEI to align its community projects with the SDGs. We believe that the project team needs to do some persuasion with senior university authorities to encourage them to use some of the SSM procedures used here. This might be based on argument that managing community projects is a learning process in which a new situation will appear and the project team should be ready to start the cycle again. By aligning the projects with SDGs, this will expand the project's mission and, will unite and drive the expectations and achievements of all stakeholders involved.

- We are aware that the results presented here are limited and need to be taken with some caution. Firstly we have applied SSM features to just one of the community projects

proposals. Secondly, we do not claim that SSM is the only systemic methodology to be used for the purposes of aligning community projects objectives with SDGs. Furthermore, other research needs to be conducted to ascertain the validity of SSM benefits as well as to try other participative systemic methodologies from the management science and systems fields. This is particularly from the 'soft' end of the management science spectrum, such as cognitive mapping and strategic choice analysis, amongst others.

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