

# **Sustainability Science Excellence Centre (SSEC): Working Together with Higher Education towards a Sustainable Future.**

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This paper introduces the Sustainability Science Excellence Centre (SSEC), a research and knowledge transfer centre implementing the 17 Sustainable Development Goals (SDGs). The SSEC practices the sustainability science approach to support innovation in science, technology, education, policies, and business. Sustainability Science is becoming a developing principle for the achievement of sustainable development by the 21st century. It is about integrating multidisciplinary knowledge of sciences and implementing this knowledge to practice in a collaborative learning manner. This paper presents the overview of sustainability science as a developing phenomenon, and the rationale of SSEC is outlined. A review of the existing sustainable development centers and climate change research centers located in the United Kingdom are included in this study, highlighting the mission and current knowledge transfer operations. This paper offers a resource about building capacity of research centers and the pathways of advancing quality education. The necessity of incorporating sustainability science principles as broadly practiced and valued by SSEC illustrates how the sustainability science practice can contribute to the enhancement of achieving progress in sustainable development.

## **Background**

Globally, higher education and research institutes have placed more emphasis on research and knowledge transfer focusing on both topics of sustainable development and climate change. The implementation of the 2030 Sustainable Development Goals (SDGs) mission and framework has been a regular trend across several academic institutions. The SDGs accelerate climate action while stimulating educational awareness about the relevance of dealing with sustainability. There is now a pressing need to generate new literature on the connections between science and sustainability. This is so for two main reasons. Firstly, there is acknowledgment about the implementation of sustainability science through the evidence of available recent research studies indicating that sustainability sciences are easy to replicate and are relevant to implement for the case of today's urgency to achieve sustainable impact. Although there is existing research on sustainability science, secondly; there is still a lack of existing literature that intently researches the definitions of sustainability science. At the same time, the majority of available research articles lack in providing an in-depth understanding of the sustainability science concept and describing the market trends. The subject matter of sustainability science needs to be better analysed, comprehensively documented, and regularly discussed to provide a support basis for action. Doing so can lead to the development of emerging fields such as sustainability science, whereby the role of research institutes and scientific centres cannot be excluded. Both scientific education and scientific research are important drivers to cultivate sustainability transformation amongst communities, businesses, and public

policies, and to condition academic practitioners about sustainability stewardship. More specifically, science bridges the gaps in communities accessing equitable skills and knowledge according to the SDG10 “Reduced Inequalities”. Meanwhile, scientific centre become a solution to achieve targets related to SDG 4 “Quality Education” and to drive innovation as described by the targets of SDG 9 “Industry, Innovation, and Infrastructure”. Research centre and scientific institutes play a key role to introduce sustainability science modules, developing knowledge resources, stimulating learning pathways, and promoting best practices.

There are at present many business models and institutions which attempt to incorporate the term “excellence”, as an effective way to brand their commitment to sustainable development and on the one hand to be a leader in a specific specialization. Even though the term “excellence” is now widely used, this term can be challenged as a visionary pursuit, requiring better clarity around its significance. This research addresses this gap of combining “excellence” with research institutes and sustainability-related centres. It illustrates the experiences of one of the first few Sustainability Science Excellence Centre in the world, in which this work document provides much-needed clarity about the principles and practices of sustainability science, the incorporation of this concept and curricula towards an institute, the role of sustainability science, the challenges, and the aspects of enhancing collaboration with higher education.

### **Higher Education Engagement in Sustainable Development**

The subject of sustainable development has been given a special emphasis in most higher education curriculum and in state-of-the-art research projects. There is an endless perceived need for mobilizing resources and engaging various stakeholders when linking the teaching, research, and knowledge transfer about sustainable development matters to inspire practitioners and to advance sustainable solutions. There are many publications highlighting the sustainability achievements stemming from the university governance in taking leadership in building more sustainable campuses, as well as incorporating sustainability themes into module courses. Sustainable campuses are used as an interchangeable term to ‘green university’, ‘green campuses’, and ‘green curriculum’. This means that a sustainable campus is defined to be an academic facility or a university which implements environmental responsibility in practices and in curricula (Sugiato et al., 2022). The concept, theory, practice, and knowledge on sustainability is embedded across teaching subjects, projects, and campus events or activities. Building a sustainable campus requires the mobilization of different agents and academic practitioners within the campus, to participate and commit towards fulfilling the set targets and planned strategies to achieve sustainability impact. The chase towards branding a higher education as leaders of sustainability have initiated a friendly race amongst different institutes and universities to earn recognition for their impact in sustainable development through global awards and sustainability ranking such as the *Times Higher Education*, *People and Planet League*, *Sustainability Tracking, Assessment and Rating System (STAR)*, and *UI Green Metric* (Galleli et al., 2021). As a result of this evolution, academic practitioners and scientific professionals working in arts major, engineering major, and any other scientific majors are now embarking on a new knowledge transfer culture where complex problems about sustainability are linked to the fundamental knowledge of a subject matter.

Sustainable development thus becomes a natural shared goal across higher education, whereby different agents are gathered within the higher education facility to further inspire sustainability-related activities. The higher education engagement in sustainable development can include active implementation across teaching and research activities, setting periodical targets of achieving sustainability objectives or organizing in-campus and off-campus campaigns or events to promote sustainability. In more developed countries, it is observed that much emphasis is placed on strategic pursuit of sustainable development. Higher education establishes alliances or network with other higher education, whereby these alliances or network of institutes undertake mutual goals, share resources, and collaborate on several portfolios of academic activities. Often, a network of higher education and alliance acknowledges that sustainable development is a collaborative effort, in which emphasis is put in place based on the SDG17 Partnerships for Goals. University partnerships in particular, form synergies to progress towards sustainability in a more rapid time frame, and in a more cost-effective manner. Due to the expansion of innovation culture in higher education, universities are starting to solve bureaucratic procedures; and changing contemporary governance structure towards a more dynamic governance structure. This means that agents of higher education can impart positive attitudes and participate in active decisions concerning sustainability. The image below shows the scale of innovation that occurs during the phase when higher education engages in sustainable development.

**Image 1: The transition of economic impact of higher education when increasing engagement in sustainable development (SD) and enhancing collaboration.**

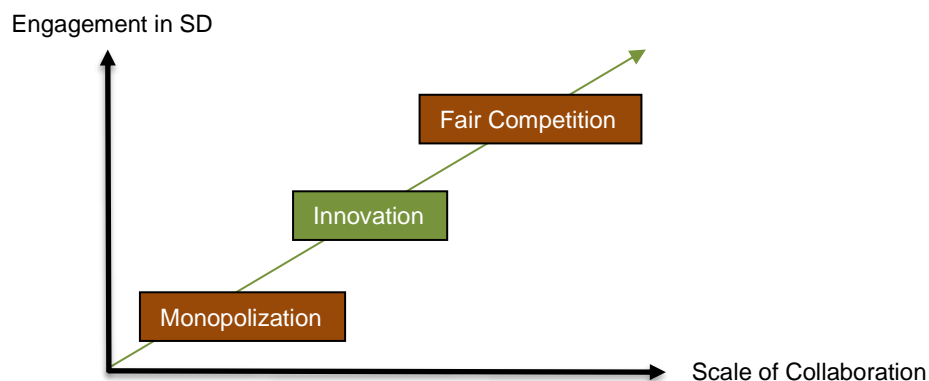
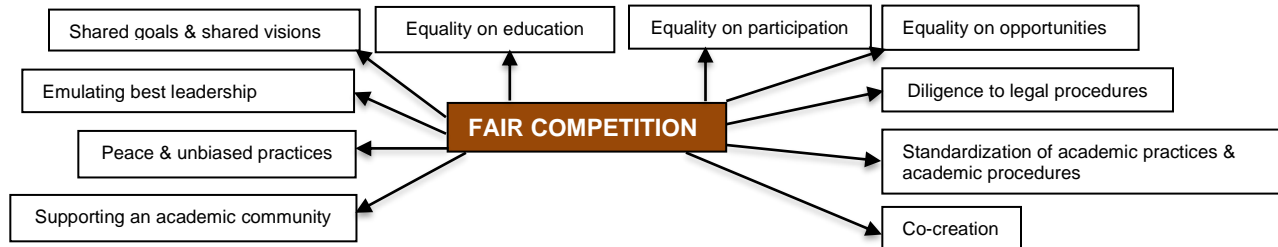


Image 1 shows the current trend of higher education engagement in sustainable development and its economic impact. Innovation is achievable through increase in engagement in sustainable development and increase in the scale of collaboration. As innovation transition happens, the nature of economic relationship between higher educations will transition towards a fair competition market. This means that higher education no longer put emphasis to only be the sole go-to place in sustainability. Higher education accepts that sustainable development is a common theme, common goal, and common strategy to survive in the academic and research sector. Without competing in the same sustainability theme, there is no survivability of the higher education and the relevance of the higher education in the current economy will be at risks.

Image 2 shows a detailed elaboration about what fair competition means for higher education which engages in sustainable development.

**Image 2: Elements of fair competition**



Fair competition may not implicitly indicate that all higher education will be engaging in unhealthy competition or a combative culture to be the best. Fair competition can indicate that majority of higher education which engages in sustainable development, are experiencing a healthy sportsmanship culture to embrace qualities of sustainable development, and to enhance the academic community by enabling positive traits such as leadership, justice, equality, peace, respect, collaborative, and harmonization of academic practices and academic procedures. In less developed countries however, it can be observed that fair competition is not so develop as compared to more well-established higher education which governs sustainable development activities more effectively. Less established institutes have more challenges than well-established institutes. Hypothetically, it is often that the more established an academic institute is; the higher likelihood for the particular academic institute to be successfully engage in sustainable development and fair competition. Less established institutes will always confront challenges to progress in sustainable development when competing with more established institutes that can monopolize the academic market in a specific geographic area. Hence, there is a need for academic institutes of any profile to increase innovation and increase collaboration, to be able to penetrate the fair competition market. Academic competition has evolved to be more institutional, global, and rely on the benefits of alliances where networks are built, resources are shared, and co-operation become natural among members of higher education (Musellin, 2018). Kettunen, K et al. (2022) research stated that there is an existence of the pseudo type of competition which emerges when two agents work towards mutual aims, and act upon both parties' interests. Differing from real competition, in which case two parties or agents pursue an interest or benefit competitively to which one of the parties cannot acquire. In this scenario, real competition can exist in today higher education or research environment; yet in the pursuit of sustainability and innovation in science, the pseudo type of competition is more fitting. The table in the next page showcase a sample lists of existing research centres or academic-driven institutes in the United Kingdom, engaging in the subject matter expert of sustainability and climate change. Based on a sample of identified institutes, it can be assessed that sustainability engagement and climate change related research has become a common trend across United Kingdom. Also, common terms are stated in the mission of the institute such as interdisciplinary, excellence centre, and with a common purpose to gather stakeholders.

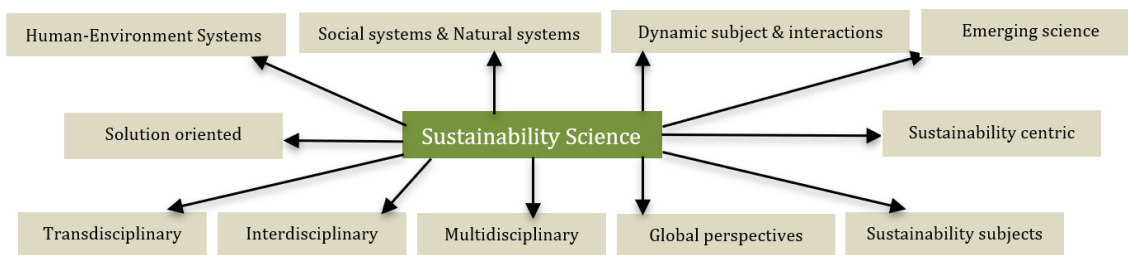
**Table 1: List of Sustainable Development or Climate Change Focused Centers.**

<b>Academic Institute</b>	<b>Establishment</b>	<b>Mission</b>
Stockholm Environment Institute, Oxford University	Since September 2022	Conducts frontier research to bridge science and policy on climate-related issues and sustainable development..Develops new tools, networks, and platforms to generate broader insights, and to steer policies and practices toward sustainability.
Cambridge Institute of Sustainability Leadership, University of Cambridge	Approximately since 2013	Brings together business, government and academia to find solutions to critical sustainability challenges.
Grantham Institute, Imperial College London	Since 2007	To contribute to, and lead on, world-class research, training, and innovation towards effective action on climate change and the environment.
Tyndall Center, University of Manchester	Since 2000	Undertakes world-class research to deliver agenda-setting insights on energy and climate change. A research community that brings together natural scientists, engineers, social scientists and economists to produce socially impactful and policy-relevant interdisciplinary research.
Birmingham Institute for Sustainability and Climate Action (BISCA), Birmingham University	Approximately since 2022	Collaborative platform to nurture expertise and develop partnerships to tackle global sustainability challenges.
Edinburgh Climate Change Institute, University of Edinburgh	Since 2010	Inclusive hub for researchers, policy makers, businesses, students, and educators. A centre of excellence building a community to tackle climate change and working on externally funded challenge driven projects.
Centre for Sustainable Development Law and Policy, Durham University	Since 2022	To support the achievement of sustainable development in all its dimensions: environmental, economic, social.
Priestley Centre for Climate Futures, University of Leeds	Since 2016	An interdisciplinary climate research, innovation, and learning centre, using our world-leading expertise to shape a better future for our communities, our region and the world. Through collaboration with businesses, governments and civil society, we harness our expertise in climate research to develop innovations, deliver education and inform policy for a fair, resilient and decarbonised world.
Institute for Global Sustainable Development, University of Warwick	Since 2019	Connecting ideas, policies, people and action as a gateway to sustainable development. Committed to delivering world-leading research on global sustainable development.
Futures Cities Research Institute, Lancaster University	Since 2021	Create an innovative, interactive platform for collaborative research, training, education and engagement across the future cities' agenda. Its interdisciplinary approach to research will support international collaboration to tackle global challenges and the UN's Sustainable Development Goals (SDGs).
Centre for Sustainable Solutions, University of Glasgow	Since 2020	To enable individuals, communities and organisations to act towards a sustainable future through education, research and partnership. We support interdisciplinary, cross-campus and cross-sectoral solutions to climate change.
Sustainability and Resilience Institute, Southampton University	Info unavailable	Research focuses on 3 main areas: renewable energy, decarbonisation and waste management; climate change and health; and nature-based solutions
York Environmental Sustainability Institute, York University	Info unavailable	To facilitate and deliver world-class collaborative interdisciplinary research on environmental sustainability, co-designed with the researcher community, industry and policymakers
Centre for Climate and Environmental Resilience, Newcastle University	Info unavailable	A transdisciplinary Centre of Excellence. To deliver the solutions we need to increase climate and environmental resilience. Acts as a catalyst for the creation of a solutions-driven research programme.
Centre for Sustainable Transitions: Energy, Environment and Resilience (STEER), University of Loughborough	Approximately 2020	To accelerate the transition to inclusive, sustainable and resilient energy systems through innovative research, analysis and capacity building.
Leverhulme Centre for Climate Change Mitigation, University of Sheffield	Since 2016	Brings together researchers from a wide range of backgrounds to explore the potential of using enhanced rock weathering on croplands to remove CO2 from the atmosphere.
Grantham Centre for Sustainable Futures, Grantham Foundation for the Protection of the Environment and The University of Sheffield.	Approximately 2018 or earlier	Experts from academia, business and policy come together to create a sustainable future. Mentoring the next generation of sustainability researchers: <i>the Grantham Scholars</i> .
South Yorkshire Sustainability Centre, University of Sheffield	2023	Connects world-leading research with regional partners to develop and implement plans to reduce emissions, while also providing jobs and economic growth
Institute for Global Sustainable Development, University of Sheffield	Approximately 2020 or earlier	An international centre of excellence, uniting researchers from different disciplines to address global challenges in collaboration with partners and communities worldwide. Key research themes are: Health, Environment, Rural Livelihoods, Cities, Digital, Data, and Innovation.
Environment and Sustainability Institute, University of Exeter	Since 2013	An interdisciplinary centre leading cutting-edge research into the problems of, and solutions to, environmental change. Focused on ecosystem dynamics including biodiversity renewal, renewable energy development and the importance of partnerships and public engagement in delivering change.

## Principles of Sustainability Science

Sustainability Science is characterized as being problem-focused and addresses problems through research (Nelson et al., 2012). The knowledge and discipline field of sciences seeks to facilitate the transition toward sustainability practices whereby the interconnections between humans and the planet are built; also, term as the understanding of human-environment systems (Clark, 2007). Alternatively, the subject address challenges of sustainability whereby both social systems and natural systems have linkages (Kates, 2011). Sustainability Science can be interpreted to compose transdisciplinary or interdisciplinary scientific practice. Sustainability Science is a dynamic subject and discipline that is bringing together diverse scholarships, and global perspectives from different scientific disciplines (Clark and Dickson, 2003) The nature of Sustainability Science can also be distinguished to be more descriptive, more analytical, and more emerging in both theory and practical science (Spangenberg, 2011).

**Image 3: Principles of Sustainability Science**



The figure above showcases the common principles of Sustainability Science. Sustainability Science can be identified as a complex knowledge and complex scientific practice specifically focusing on the subject matter of sustainability. As a result of the engagement in sustainability development and the global priorities on addressing complex problems such as climate change, multidisciplinary research and education has now started to become more mainstream. Multidisciplinary exchange of scientific knowledge led to progressive results in the scientific and technology arena. As a result of this evolution, sustainability practitioners and professionals working in complex climate change field are embarking on increased capacity building opportunities which are interconnected to sciences. Globally, though there are several specialized research institutions and higher education centers which offers the opportunity for professionals to pursue diverse subjects intersecting in sustainability. However, there is still a lack of institutions specializing in the subject matter and practice of sustainability science. There is still a perceived need for this emerging discipline to evolve, demanding more collaborative research which go beyond the trivial and create scientific frontiers. One benefit of the incorporation of sustainability science approach is that it allows the strengths of every scientific domain to complement one another. This includes enabling more effective discussions to derive the fittest solution and explore beyond the norm.

## Mission and Objectives of Sustainability Science Excellence Centre (SSEC)

SSEC is a research and knowledge transfer centre comprising multidisciplinary agents which engage on any work or communication related to sustainability science and addressing global sustainability issues. It is a go-to centre of knowledge and resources, in developing sustainability solutions, coordination of educational or scientific activities, and coordinating actions to achieve mutual goals on both sustainability and science impact. The mission of SSEC is to enable progress of science, sustainability solutions, and innovation, within the teachings and research of sustainability science. The centre operates on varied activities and events addressing on any matters related to sustainability vis-à-vis, addressing complex global problems such as climate change, global health, global security, global economics, policies, and biodiversity subjects.

The SSEC develop objectives based on the motto of Marcharh - "*Sustainability, for a Better Tomorrow*". SSEC motto is - "*Harmony, Innovation, and Exemplary*", suggesting that action of collaboration is encouraged to ensure more synergies between sustainability and science measures.

### Image 3: Motto of SSEC



At the same time, the service and engagement from SSEC should be innovative, trustworthy, and exceptional in performance. Amongst the identified objectives of SSEC are the following:

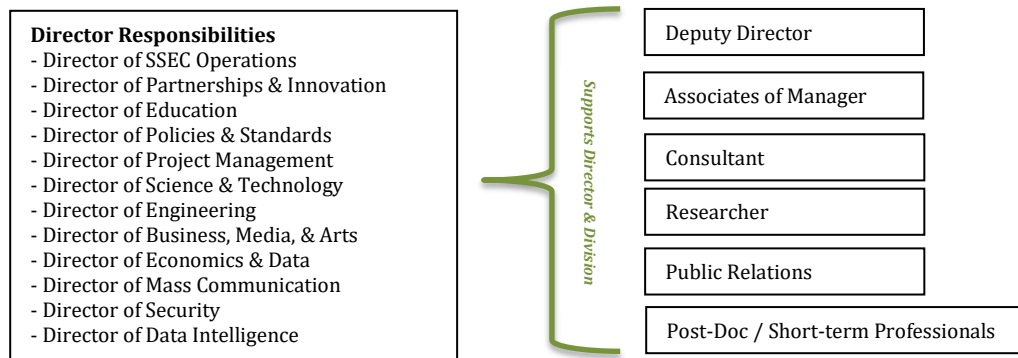
- 1) To function as the go-to centre in providing professional advisory services, professional education, and professional research whereby up-to-date scientific knowledge and sound scientific solutions are developed.
- 2) Enables stakeholders and engaged with institutions or with businesses to implement sustainability science strategies and participate in the knowledge exchange of sustainability science.
- 3) To function as an exceptional centre of research and knowledge transfer, enabling progress and driving innovation in both sustainability and science.
- 4) To provide support and collaborate with other agents, institutions, and agencies towards sustainability and climate-related ambitions.
- 5) To work harmoniously with other institutes and with higher education towards common goals.
- 6) To increase opportunities for all profile of society, whereby access to science, access to education, access to professional job is provided.



- 7) To set exemplary ethics, high standards, and well-grounded practices in the specialisation of sustainability science.
- 8) To foster a culture of multidisciplinary education and research.

### Governance of the Sustainability Science Excellence Centre (SSEC)

The SSEC is owned by Marcharh, and the SSEC is governed through nomination of sustainability experts as well as through employment of selective advisors and management roles. The SSEC is not govern by financiers stakeholders or any agent outside the official designation of roles or assignment of formal responsibilities. Among the governance responsibilities include the boxes below:



The SSEC governance is driven by different profiles of leadership. Both the “Chairman” also known as the “President” of the research centre, and “Vice-Chairman” or also known as “Vice-President” are non-nominated, but intently assigned based on a high assessment about their skills, work experience, credibility, personal motivation for the research centre, and capacity to lead the entire research centre governance.

### Sustainability Operations of the Sustainability Science Excellence Centre (SSEC)

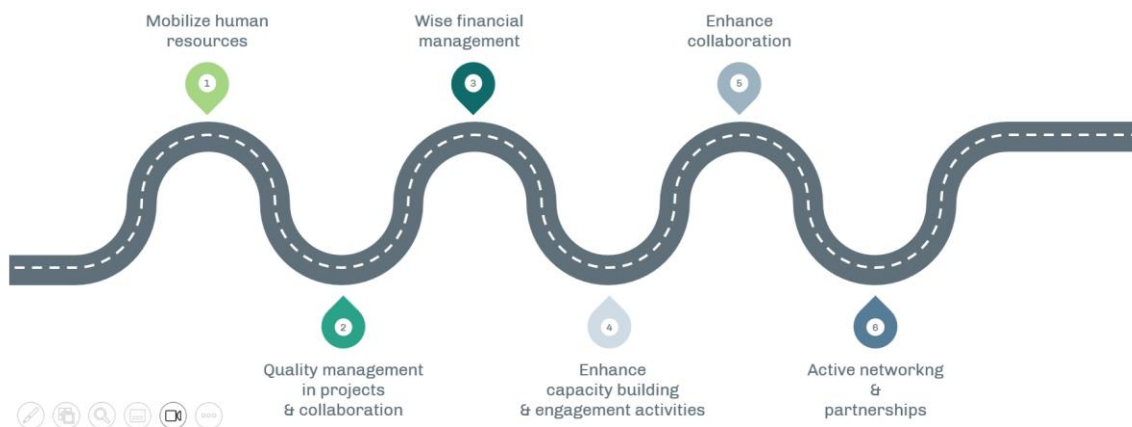
Since the year 2022, the SSEC needed to adapt to the challenges of maintaining the operations of a research-based institute. As initial funds were limited, the SSEC incorporated “smart finance” program whereby investments are strategically planned to ensure that the initial outlay and initial capital for SSEC to operate will be minimal. To do this, unnecessary human resources are minimized at the most minimal level; while irrelevant projects which are assessed to provide small amount of return on investment are less prioritize than projects which are assessed to provide better benefits. By limiting the number of committed research projects and choosing the best quality research projects; SSEC was nearer to achieve the objectives of the “smart finance” program. The sustainability operations of SSEC also requires a combination of funding mechanisms such as research grant from any sector and stakeholder, capital investment by investors, trust funds, and generating revenue by selling professional commercial services. The sustainability operations also depend on the long-term costs to afford legal procedures and licensing. Renewal yearly fees and legal fees can implicate large costs for the daily operations and maintenance of SSEC. As managing sustainable finances for research institute is a complex process, there are knowledge gaps for the business development



leaders and management leaders to be able to create inventive financing solutions. Ample finance and business training is required to enhance the skill and knowledge about sourcing finance mechanisms. Additionally, when it comes to submission of research grants proposal; adequate level of experience and professionalism is expected to execute this elaborate task. Research grant proposal are also more easily granted when the profile of the researchers is credible enough to qualify all the criteria(s), and the financier acknowledges the credible stature of the institute. There is a lot of improvement actions that needs to be done at SSEC. The SSEC also needs to focus on identifying the mainstream of funding channel it can strive to plan. By striving on at least on funding channel, the operations of research institute can be sustained. The sustainable operations of SSEC are dependent on the retention of high-quality human resources. This means avoiding a high turnover, especially across management level roles and creating beneficial employment packages to incentivize long term employment. Human resource planning needs to be done to fulfil the knowledge, skills, and support needs of the research centre.

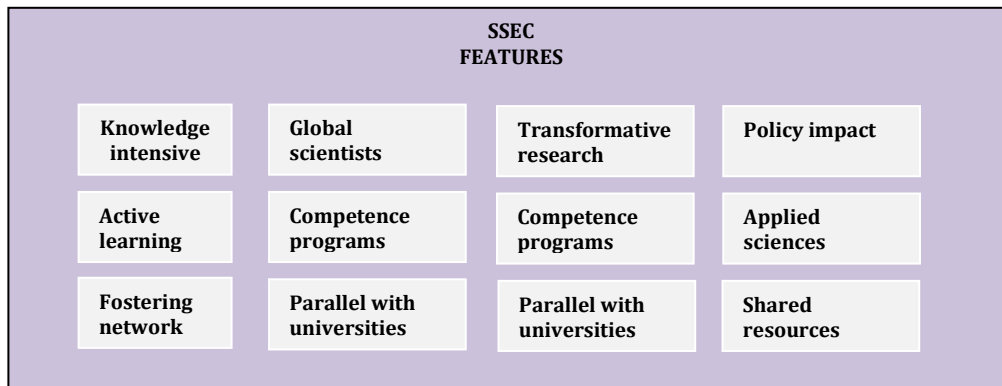
In the case whereby the total employed human resource is kept at a low level for SSEC, the sustainability of its operation depends a lot on active capacity building and active networking engagement. More resources, expertise, and support can be mobilised by increasing training, increasing educational events, increasing professional meetings, and increasing networking with professional stakeholders or institutions. Image 4 indicates a summary of the key actions required by higher education and research centres (including the SSEC as a case example), to address different challenges.

**Image 4: Key actions by higher education and research centre to address challenges in sustainability science objectives.**



The pursuit of “distinction” or “merit” in academia is omnipresent; while operating a research centre that is “beyond reproach” or defined as impeccable in performance are amongst the desired result. Apart from these mentioned features, today’s research agenda about dealing with the complexity of socio-economic and environmental themes suggest that there is essentiality in building a forward-thinking research centre which incorporates several features. These features are described in image 5.

**Image 5: Features of research governance and operations of the SSEC.**



According to ENQA (2014), “excellence” denotes high quality and exceeding high standards. These attributes are incorporated across research, recruitment of human resource, job packages, research and teaching facility, financial resources, academic culture, intellectual development, and scientific faculty governance. Different research centres worldwide and academic faculties have varied approaches taken in terms of its governance format and approaches. The research thus far has shown that the establishment of the SSEC adopts contextual and practical scientific approaches to address global subjects with an aim to promote a global science, while aligning to the UN Sustainable Development Goals (SDGs).

**Incorporating capacity building in research center to foster science-policy engagement and outcomes.**

By understanding the nature of engagement of higher education in sustainable development and understanding how majority of established research centres embodies similar operational qualities; the research outcome highlighted that incorporating capacity building is a critical action forward. On this basis, the existing 6 years research institute called Marcharh; had embraced these qualities and further developed a research centre called the Sustainability Science Excellence Centre (SSEC) by the year 2021.

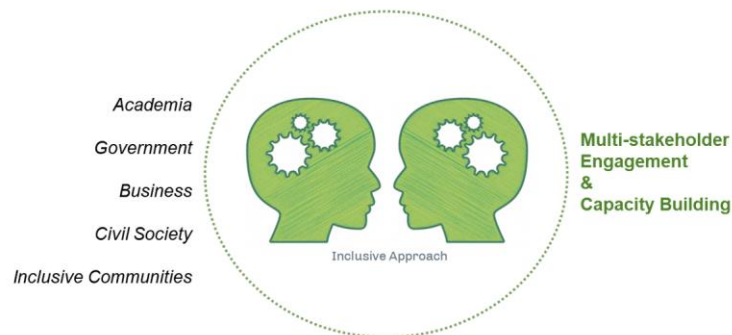
The experimental phase of the development of SSEC went through an observational study about the prominent issues surrounding the subject of sustainability, climate change, natural resources, education, policy, innovation, and business. During the year 2021, capacity building on the topic of sustainability science was active as shown in image 6.

**Image 6: Examples of capacity building in public events on the subject of Sustainability Science**



The lesson learnt from the engagement in the public events and science-policy dialogues is that the subject of sustainability science is centred in the interest of academia, business, industry, and with the government. It is also observed that sustainability science is a multi-stakeholder process, whereby diverse stakeholders share different scientific and technical expertise in sustainability themes. Pucciarelli, F and Kaplan, A (2016) investigation highlighted about the importance for higher education to enhance professional interactions and create co-creation value with key stakeholders. Moving forward in the agenda of Sustainable Development, research centres need to work together with higher education towards a sustainable future. One approach to work together is to put to practice a multi-stakeholder engagement process coupled with capacity building.

**Image 7: Towards an inclusive approach to manage a multi-stakeholder process**



Acknowledging that the subject of sustainability science entails complexity in analysis, decision making, and solution development; this complexity can be dealt by moving towards an inclusive approach to create multi-stakeholder partnerships. Image 7 shows how different stakeholders are involved in the analysis and engagement of complex subjects and broad mission such as sustainability. It calls for more inclusivity in dialogues, and to leverage on multi-stakeholder platforms. When multi-stakeholder engagement is combined with increased capacity building, this automatically also develops more inclusivity. In today' scenario, whereby different agents have varied interest to pursue sustainability, innovation is a pressing action area to progress in science. At the same time, capacity building leads towards development of interconnectedness in cross-sectors such as amongst policy, technology, and the economy.

## **Conclusion**

The literature review provided initial context about how sustainability science is becoming a central knowledge and practice across scientific driven institutes. It can be advantageous to both the higher education and research centre, when engaging in capacity building activities, while enhancing partnerships to promote collaboration and innovation. Both innovation and capacity building are essential strategies in the new fair competition market. Sustainable development can be achieved in profound ways, whereby science becomes a channel to drive sustainable transformation more effectively. Multidisciplinary teaching and research also play an essential role in supporting the knowledge transfer of sustainability science. Learning from the case of the SSEC, this existing research centre oriented to sustainability science is a source of how sustainability science knowledge transfer can support the sustainability transitions. Moving forward, there is a perceived need to support the SSEC current activities and future sustainability operations efforts. The global issues on sustainable development can be tackled by the contribution of practitioners of sustainability science. This outcome can be achieved when both public or private scientific institutes work together towards a shared goal, shared missions, and embracing a fair competition market.

In conclusion, sustainability in research and education is becoming a central practice across institutes. The literature review provided initial context about how a fair competition market is evolving during the increased capacity building activities and innovation pursuit in sustainability related subjects. There is an apprehension to also support sustainability science subjects. In this case, the concept and development of Marcharh SSEC has become a relevant reference and a pre-eminent research centre since the year 2021. Sustainable development can be achieved in profound ways, whereby science becomes a channel to drive sustainable transformation more effectively. Global issues on sustainable development can be tackled by interlinking the science-policy with nexuses of education, research, teaching, and business around the theme of sustainability science.

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