

Plug-in campus for accelerating and catalyzing software engineering education in the Global South

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Abstract—A plug-in campus refers to a physical extension of a base university, within the premises of a host university. While academically independent from the host university, a plug-in campus makes use of the host’s infrastructure and integrates into the local knowledge and innovation ecosystem. The Future Technology Lab illustrates the role and functions of a Finnish plug-in campus in Namibia, focusing on, but not limited to software engineering education. Introduced as an alternative to a full-scale branch or satellite campus, a plug-in campus emphasizes contextual innovation, collaboration and mutual interaction between the base and host universities that the plug-in campus is expected to catalyze and accelerate. The resilient orientation enhances the sustainability of a plug-in campus in the dimensions of economy, environment, society, and ethics.

Keywords—branch campus, plug-in campus, sustainability, software engineering, Future Tech Lab

I. INTRODUCTION

While many well-known universities from the Global North have branch or satellite campuses in the Global South, these overseas units often operate as independent degree outlets of their home bases, offering copies of the programs developed in and adapted for the contexts of the base universities’ origin [1]. This can lead to a situation where the overseas campus becomes a competitor rather than a collaborator to the offerings of the native universities in the Global South.

We introduce a complementary category of overseas campuses, called a *plug-in campus*. A plug-in campus refers to an arrangement where a foreign university (usually from the Global North, also called the base institution or university) sets up its presence by allocating its faculty at a physical and permanent space within an existing university (usually in the Global South, also called the host institution or university). The base institution usually wants to reshape itself by the challenges of another geographical and demographic context, while the host institution wants to renew its education, research, or societal impact.

The bi-directional and mutually beneficial relationship between the base and the host should be that of collaboration, growth, and cross-inspiration, rather than competition or one-directional support. Thus, the plug-in campus, while independent in its operations from its host institution, is a catalyst to its host. It ought to accelerate the host’s renewal, without merging to it. Size-wise, the plug-in campus is significantly smaller than its host. It is the intensity of the operations, rather than the size of the plug-in campus that matters.

In this paper, we present the concept of a plug-in campus and its realization as the Future Tech Lab (FTL, flab.utu.fi). Furthermore, we discuss how we applied the four sustainability pillars to make our plug-in campus viable.

II. AN OVERSEAS SOFTWARE ENGINEERING DEGREE PROGRAM AT A PLUG-IN CAMPUS

The Future Tech Lab of the University of Turku (UTU), Finland, located within the main campus of the University of Namibia (UNAM), in Windhoek, is a concrete example of a plug-in campus. In setting up the FTL, the base institution aimed to attract motivated students who would co-design future solutions to the challenges of the host country and continent, on-site. The host institution, on the other hand, aimed to meet the demand for highly competent software engineering graduates that have learned to work closely with businesses or have initiated their startup while still studying.

Based on the complementary expectations, the base university rented, renovated and redesigned a 200 m² space within the host university, fit for modern pedagogies in software engineering. The multipurpose space, while small, is already allowing businesses to work together with the academia throughout study programs.

In software engineering education, the tasks of the plug-in campus range from individual coding courses to a full-fledged Master of Science degree program in Software Engineering, to a Doctor of Philosophy in Computer Science class. All learning activities in the FTL are tied to research, development and innovation (RDI) projects, and are collaboratively carried out with the end-users of the host country, whenever possible. These projects focus on multilingualism in Namibian education, Carbon Garden as a real-life platform for mitigating the impact of the climate change, use of digital music for learning mathematics, and remote presence [2]. Other functions of the FTL have this far included an educational robotics workshop where students innovated pilots using elementary robotics, a KaiOS workshop where students enhanced their programming skills by co-designing applications to cope with the climate change, and research seminars, where researchers from different disciplines came together to share and discuss their work and find new colleagues to collaborate. The plug-in campus also secured collaboration with both local and international industry partners. Through this collaboration, one partner, Eduix hosted a workshop that trained local software engineering graduates and start-up companies. The FTL also hosted the first UNESCO southern summer school in February 2020, which integrated software engineering in the real application areas of tourism and fashion [3].

At the initial stage of the FTL establishment, we realized a key trade-off between the physical and digital affordances of the learning environment of the campus. The less physically available resources we have, especially space and local faculty, the more we require from the digital infrastructure. Novel technological solutions—that exceed the affordances of conventional videoconferencing—are required for remote

collaboration, to anchor the base's operations on the ground at the plug-in campus. This observation sparked our interest in designing an appropriate remote presence environment for sharing a learning experience between the learners at the base and host campuses.

On the other hand, the operations of the plug-in campus must be integrated into the academic and societal realities of the host in the surrounding context. Also, the plug-in campus needs to be integrated into the local science, technology and innovation ecosystem to ensure truly shared academic learning, research, and societal impact experiences. To achieve the full use of these linkages, we have started to analyze the expectations of Namibian, i.e. local, industry from the software engineers that the plug-in campus will train.

III. PLUG-IN CAMPUS VS. BRANCH CAMPUS

According to our definition, a plug-in campus and a branch campus are instances of a more general concept of an overseas campus. An overseas campus refers to any arrangement where a base university operates in a foreign, i.e. overseas, context [4]. In general, while a branch campus emphasizes its established status within a foreign context, like accreditation of its operations and degrees according to the local legislature [5], a plug-in campus prides of its dynamic nature as a resilient or even pioneering catalyzer and accelerator of both the base and the host university. A branch campus focuses on assuring the quality of its main campus' offerings in the satellite's context [6], whereas a plug-in campus is exploring and crossing the borders. Otherwise, the actual functions of plug-in and branch campuses resemble each other. They are both instances of a university and, hence, facilitate learning, research, and societal impact, locally and globally. The main difference is in the ways they accomplish their agenda. While the concept of a branch campus is heavier than that of a plug-in campus, the former suffers from related pressures, especially in terms of the faculty and students. Since degrees offered at a branch campus are adopted from base universities, the branch campus strives to provide the same contents and quality of education as that offered at the base university [7]. However, attracting professors from the base university and students with educational qualities that largely match the ones at the base campus seem challenging [4].

Table I summarizes the principal differences between a plug-in campus and a branch campus, listing the key characters.

In practice, an individual overseas campus might have features of both categories. For example, the Future Tech Lab has also brought in its own partnerships from Finland, like those with other European research groups. Although overseas campuses depend on base universities at the beginning of their operations, this is not sustainable in most cases [8]. There is little evidence of sustainability when establishing branch campuses: a branch campus can be a damage to the academic standard, and lead to financial losses and poor services to students [8]. The overseas campus will only yield the same results as those of the base university if resources such as funds, professors and students are the same as their base university [8].

To summarize, one of the key challenges of an overseas campus is that of sustainability. Since our plug-in campus promotes collaboration between the UTU and UNAM, the sustainability of the plug-in campus naturally depends on both universities. The next section will further analyze the sustainability factors of a plug-in campus.

TABLE I: PLUG -IN VS. BRANCH CAMPUS

	Plug-in campus	Branch campus
Location	<i>Within the premises of a host university</i>	Independent location
Relation to local universities	<i>Accelerator and catalyzer of the host university; networking collaboration with other local universities</i>	Competitor
Modus operandi	<i>Resilience for adapting to the local expectations from which it sources inspiration</i>	Import of functional models that work in the base environment
Infrastructure	<i>Makes use of the infrastructure of the host university</i>	Builds its own infrastructure
Linkages	<i>Integrates to the local ecosystems using the links of the host university</i>	Brings in the networks of the host university
Size	<i>That of a small department or laboratory</i>	That of a small university
Faculty and staff	<i>Mostly recruited locally or working online from the base campus</i>	Brought in from the main campus with experience from the base
Key technologies	<i>State-of-the-art online technologies, including remote presence, requires the fastest available connectivity</i>	Conventional technology for onsite teaching
Qualification authorization	<i>Administered by the base university according to its legislature</i>	Accredited in the host country
Establishment Approval Process	<i>Agreement between base and host institution</i>	Needs to be approved by host country

IV. SUSTAINABILITY OF A PLUG-IN CAMPUS

Sustainability is a common principle that is recognized by most universities worldwide and a plug-in campus should not be an exception. A plug-in campus will be considered as sustainable if it meets the requirements of the present students and does not compromise on those of the future generations [9].

A plug-in campus should assist the society to make a transition to sustainable lifestyles so its resources will not negatively affect the environment, economy, and society to fulfill its functions of teaching, research, outreach, partnership and stewardship [10]. Moreover, activities conducted at a plug-in campus should be guided by ethics.

Sustainability focuses on the continuity factors of a given initiative, program or other activity [8]. Sustainability has been operationalized as the UN sustainable development goals (SDGs) and mainly consists of the three pillar concepts: economy, society, and environment [9] [11]. In [12], a fourth pillar, the ethical pillar of sustainability was employed because any sustainable activity is governed by working principles and goals which are reflected in the ethical pillar [12].

Fig. 1 presents the four different pillars of sustainability as discussed in [12] and illustrates how they are intertwined.

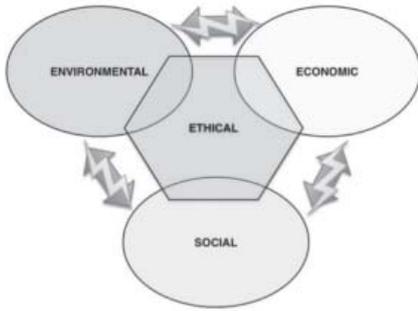


Fig. 1: The four-pillar model of sustainability, adapted from [12]

As software engineers are expected to design sustainable solutions for and with end users, sustainability also needs to be already built in their education. Hence, the FTL as an instance of a plug-in campus will provide a sustainable platform for software engineering education by taking all four pillars into account.

We will now present the models that would ensure the sustainability of a plug-in campus, in terms of the four sustainability pillars of economy, society, environment, and ethics, operationalized as the business model, culture model, ecology model and behavior model, respectively.

A. Business model

In the context of our work in progress, economic sustainability refers to the conduct at the plug-in campus that supports the long term economy of the plug-in campus without negatively impacting social, environmental and cultural aspects of the environment of the host university, in our case UNAM. These resources include but are not limited to human resources and funding that will enable the continuous running and development of the activities and programs offered at the Future Tech Lab.

For a plug-in campus, it is imperative that it gets income from heterogeneous, mutually independent sources, rather than relying on sources from one outlet, like the base campus, only. The income should come, dependently on the activities, from the industry of the base, host and third countries, grants, from participants attending workshops, summer schools, or alike, and students registered for degree programs. In our case, we offer the space also for companies, among them to the founding partners that pay their membership fees to be able to use the premises, take part in events and join networks.

Table II presents the business model by the activities conducted at the plug-in campus and their income.

TABLE II: THE BUSINESS MODEL FOR A PLUG-IN CAMPUS BY ACTIVITIES VS. INCOME

	Base campus contribution	Host campus support	Industry partners	Tuition fees	External funders
Intense courses			✓	✓	
Degree programs			✓	✓	
RDI projects			✓		✓
Societal impact initiatives		✓			✓
Host campus capacity building		✓			✓
Base campus extension	✓				

In terms of the training programs offered at the plug-in campus, methods such as online learning support economic sustainability because professors from the host university will be offering classes remotely, thus cutting the costs of bringing the teachers to the host country.

B. Culture model

Social or socio-cultural sustainability refers to providing a positive condition for (1) the internal dynamics of the founders of the plug-in campus and (2) the socio-culturally appropriate integration of the plug-in campus within the surrounding community [9]. Hence, the community involves not only the founders of the plug-in campus, students and the research community, but also the wider community, like industry and other stakeholders. Social sustainability also refers to processes—including the co-design and implementation activities of the plug-in campus within its context—that ensure that the communities in the plug-in campus achieve a positive role in the socio-culturally relevant functions of the campus [4].

Social sustainability is not clearly defined and is supplemented with many principles as identified in [4]. Equity of access to key services and co-designing them further are amongst the social sustainability principles practiced at the plug-in campus. Collaborations in projects amongst different disciplines such as tourism and fashion and amongst different universities, industries, and local stakeholders, like the Katutura Fashion Week and operators of tour adventures, to work in the plug-in campus' RDI projects has been happening at our plug-in campus.

In addition, the plug-in campus also welcomes cultural groups from outside the campus boundaries to make use of the facilities, like the local Vox Vitae choir and the Namibia Film Commission.

C. Ecology model

Environmental sustainability in the context of our work refers to the exploration of the programs offered at the plug-in campus' physical environment.

A key characteristic of a plug-in campus, compared to a branch campus, is the rational use of existing infrastructure, instead of building yet another campus. Sharing resources, even teachers, and designing novel technologies for digital connectivity even to stakeholders is a critical factor for environmental sustainability. An ecologically sound community should satisfy its needs and not cause damage to the environment for the environment to continue supporting the activities of the future generation [9].

In our case, activities at the plug-in campus should not cause harm to the environment. The plug-in campus will have a remote presence environment to be able to build a learning and research environment, shared by learners and teachers from both the base and host university. As such, the rationalization of the growing consumption of energy is of importance. Energy-saving techniques will be considered thus renewable energy such as solar panels will be installed for energy consumptions to reduce carbon emissions. For an environmentally sustainable plug-in campus, it is essential to reduce the carbon footprint of the campus.

The online nature of the plug-in campus will encourage electronic services. The high use of digital services will eliminate the use of paper and textbooks, thus reducing environmental exploitation. The plug-in campus also contributes towards ecologically friendly agriculture through one of its projects called the Carbon Garden [2].

D. Behavior model

It is critical to address ethical issues in every aspect of life especially when our plug-in campus consists of students and teachers from different backgrounds. Ethical sustainability reflects on the values such as commitment, honesty, respect and responsibilities, and shared working principles behind the plug-in campus. Equality is practiced at our campus and activities conducted at the plug-in campus are transparent and are globally accepted.

Later on, a plug-in ethical navigator can be co-designed as an app to guide the plug-in campus community in their decision-making.

E. Combined model

In their analysis of an online Ph.D. school, Suhonen and Sutinen (2014) have observed that the four dimensions of sustainability can compensate each other. For example, if the given entity, in our case the plug-in campus, has difficulties in, say, sustaining its economy, a solid ethical basis can support the plug-in campus to live through financially challenging times, by a creative reorganization of its human resources. In our case, the host university has offered its faculty to arrange some of the plug-in campus activities, without costs. The four sustainability pillars discussed in this study are mutually interrelated and, hence, possible trade-offs [12] or emerging conflicts between the four pillars need to be identified, analyzed and sorted out carefully to ensure the sustainability of the plug-in campus.

V. CONCLUSION

We presented the Future Tech Lab as a concrete example of a Finnish plug-in campus in Namibia, focusing on, but not limited to software engineering education. We demonstrated how our plug-in campus differs from a traditional branch campus, although they are both overseas units of foreign universities in the Global North, located in the Global South.

Our plug-in campus is a catalyzer and accelerator of both the base (UTU) and the host (UNAM) universities. It is important to emphasize that FTL is not a competitor of the host university. The four pillars of sustainability—economic, social, environmental and ethical—were also discussed in line with our plug-in campus, including the way that these pillars complement each other for a sustainable campus. For future work, we are planning to analyze other plug-in campus sustainability models in the Global South and derive a concrete design for a plug-in campus that is innovative and self-sustainable.

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