INTERDISCIPLINARY HIGH EDUCATION IN PLACE BASED SOCIAL-TECH: THE EXPERIENCE OF THE TAMBALI FII PROJECT IN DAKAR

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ABSTRACT

The place-based approach to innovation is a strategy that provides to communities the opportunity to innovate by triggering a systemic change. While researchers and policymakers are experimenting place-based strategies around the world, there is a need to develop appropriate educational tools to foster a place-based approach to technological and social entrepreneurial solutions. The Tambali Fii project is a step toward this direction.

This paper depicts the high-education interdisciplinary workshops "Social-Tech4Sustainability" – held at the IPP-Dakar in the first year of the Tambali Fii Project – by sketching their objectives, theoretical model, structure, tools and results, in order to present a model to transfer and/or to scale up in larger experimental and applied social-tech education program.

A validation test through qualitative content analysis of data collected in the field is carried out in order to investigate the actual potential of teaching concerning new design tools in the bottom up process of creation of place-based social-tech entrepreneurial businesses.

Keywords: social entrepreneurship, entrepreneurship education, place-based innovation, social-tech, design 4 social sustainability

1. INTRODUCTION AND LITERATURE REVIEW

Innovation ecosystems group together different actors, embedded in a series of dynamic and generative processes pursuing innovation and technology development objectives. (Jackson, 2011; Oksanenen and Hautamaki, 2014). More specifically, the members of the ecosystem provide innovative solutions to a series of shared challenges from different perspectives.

Place-based innovation ecosystems constitute a subset of innovation ecosystems. The "place-based approach" stresses a key characteristic of innovation namely that it "takes place in precise locations" and that it can offer responses to local needs (Rissola et al., 2017). The creation of place-based innovation ecosystems is gaining prominence in the innovation and development strategies of governments and international organizations both in developed and in BOP countries (Rissola et al., 2017) as in the case of the European Union.

In the context of innovation ecosystems, social entrepreneurship can play a fundamental role in mobilizing resources and addressing societal needs through innovative solutions.

In this paper, we follow the definition of social entrepreneurship as a concept collecting different organisational forms which merge the generation of social value to a paradigm of economic and financial sustainability, "demonstrating entrepreneurialism and self-sufficiency" (Swanson and Zhang, 2011). In this perspective, Pinch and Sunley (2016), Mazzei (2017) highlight the linkage of social entrepreneurship with the local "place context" and local resources, suggesting the potential of these organisations in place based innovation strategies. Actually, according to Surie (2017), social entrepreneurship can play a unique role in innovation systems by providing innovative services and products to "targeted" local population "neglected by the established firm". Consequently, the role of social entrepreneurship can be particularly relevant in the BOP countries (Surie, 2017) where uncovered societal needs are diffused. Surie (2017) also outlines a series of key characteristics at microlevel enabling social entrepreneurship to become an engine for innovation ecosystem: the "availability of social entrepreneurs" ready to tackle societal needs, the presence of fecund inter-organisational relations and the existence of "enabling technologies".

The increasing reliance of social entrepreneurial forms over new technology is leading to the definition of a new social entrepreneurial genre: that of social-tech ventures characterised by the usage of innovative technology "to solve societal issues" (Ismail et al., 2012, Arena et al., 2017) and creating scalable innovations.

In the context of BOP countries, Schonwetter and Van Der Viele (2018) recognise the potential of a new wave of digital technologies as 3D Printing as factors enabling the development of the new forms of social-tech entrepreneurship and innovation. Rognoli et al. (2015) on their side attribute this potential also to DIY materials, due to their low degree of standardisation which allows a high rate flexibility in production and adaptability to different local contexts, coherently with an innovative placed-based approach.

Also due to the rise of social-tech organisations, the interest towards social entrepreneurship is fostering the growth of tailored educational programs addressed to develop specific skills required by social enterprises (Al Taji and Bengo, 2018). Some theoretical models about teaching and training for SE have been published (among others Smith et al. 2012; Pache and Chowdhury 2012), also adopting a place-based approach to the theme (Elmes et al., 2012). Nonetheless, educational models designed at developing social-tech entrepreneurial forms are still scarce in the literature: only Dzombak et al. (2016) effort in discussing the capacity of an educational program mixing engineering and social entrepreneurship in US context. Consequently, this paper presents an educational theoretical model for social-tech entrepreneurship education, capable of making social-tech entrepreneurs key actors in place-based innovation ecosystems also in BOP countries by taking advantage of new technological tools and design instruments for societal goals.

We apply and test the model in the workshops "Social-Tech 4 sustainability" (ST4S) held at the Institut Polytechnique Panafrican of Dakar, Senegal, as part of the international research project Tambali Fii led by the Politecnico of Milan. In the following sections, the ST4S workshop is depicted through its objectives and activities, in-field test and result. In order to validate the results, a series of semi-structured interviews was conducted to understand the potential of the educational model in social-tech entrepreneurship in order to foster the development of place-based innovation ecosystems.

2. THE SOCIAL – TECH 4 SUSTAINABILITY WORKSHOP @ TAMBALI FII | DAKAR

The Tambali Fii project is a step toward the design of theoretical educational models for social-tech entrepreneurship education, by proposing an high-educational workshop to develop both technical and social entrepreneurial skills. A specific set of activities is framed in a tentative theoretical educational framework with a series of supporting tools. The framework has the goal to train designers and entrepreneurs in the field of sustainable design for social entrepreneurship, maintaining two key elements: the usage of advanced technologies and a place-based approach with a continuous reference to the local context. We apply and test the model in the

workshops "Social-Tech 4 sustainability" (ST4S), organized and run by the authors at IPP Institute Politecnique Panafricain Dakar, Senegal. The educational workshop involved 15 students with the goal of foreseen, ideate and develop PSS (Product Service System) social solution addressed to the Senegalese fishing sector.

2.1. TAMBALI FII PROJECT

Tambali Fii is an international research project supported by PoliSocial –the social engagement and responsibility programme at Politecnico di Milano (http://www.polisocial.polimi.it/)– aiming at creating a social and technological innovation Pole in Dakar, Senegal. The primary objective of the project is eliciting place-based innovation processes able to respond to social and economic challenges in the local context by training and fostering entrepreneurial activity in the field. Furthermore, the project in 2018 led to the foundation of a technological incubator in the IPP Dakar headquarter. The incubator has the objective to provide an effective technological transfer, to design and apply training programs, to foster research and synergies between academia and local entrepreneurship.
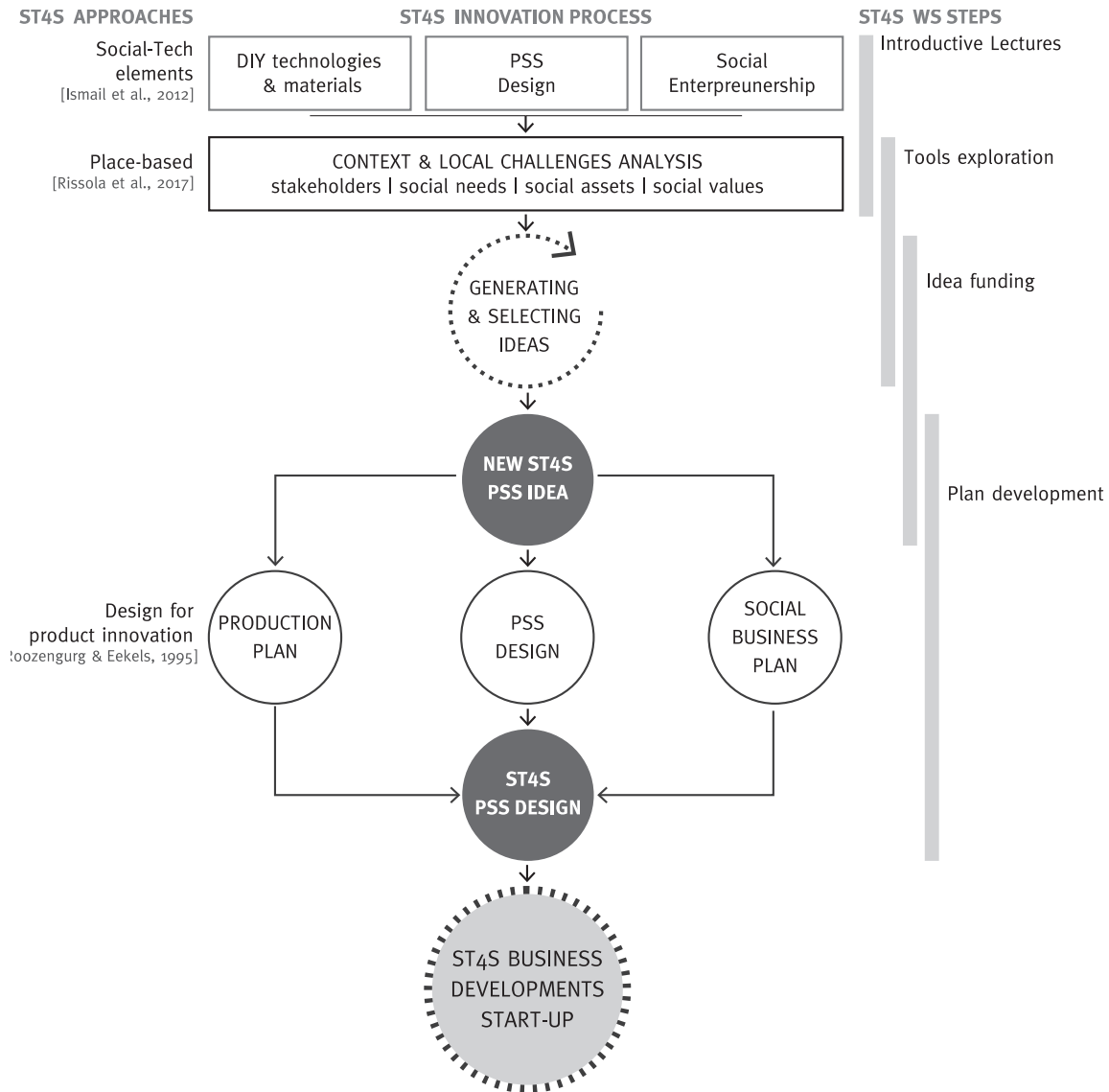In this context, the first research activity developed in synergy with local stakeholder was field research on social and technological innovation in the fishing sector including the whole boat, boatyard and fishing equipment production chain. During the research activity, innovative PSSs were foreseen as well as the social business plan to further develop it.

2.2. THE WORKSHOP METHODOLOGY

The ST4S workshop methodology was designed by the authors to reach the intended workshop objective of (i) exploiting the potential of innovative design models in stimulating place-based innovation projects able to respond to social and economic challenges in local contexts; (ii) training social entrepreneurship and design for social and technological sustainability with a place-based approach; and (iii) developing PSS project to strengthen bottom-up entrepreneurship with a place-based approach. The methodology of the educational workshop could be adopted as a training program in Academia as well as in startup, as is addressed to professionals with different backgrounds and no previous knowledge on social-tech 4 sustainability. To achieve its objectives, the workshop covers three main topics: PSS Design (and project related design sub-topics), DIY materials and technologies; social entrepreneurship. The ST4S workshop is organised in the following four steps according to the ST4S innovation process below described:

- INTRODUCTIVE LECTURES: lecture on the three main topic and subtopic including case studies and context analysis.
- TOOLS EXPLORATION: first exercises approaching the use of the tools including design tools, DIY techniques, and tools for DIY materials, and social business model canvas
- IDEA FUNDING: generating loops and selecting of the technological and social innovation strategy and goal according to the context and local challenges analysis.
- PLAN DEVELOPMENT: development of the promising ideas into a PSS plan including PSS design, DIY production plan, and social business plan. This last step drives the project to the social entrepreneurship start-up.

Based on the Product innovation process model created by Roozengurg and Eekels (1995), the ST4S innovation process [Figure 1] shows how product and PSS design is embedded in a more extensive process based on social and technological place-based innovation. The process distinguishes two main phases: the idea funding that leads up to the PSS strategy, and the development plan strict connected with entrepreneurship start-up. The ST4S process objective is to plan and manage a place-based project and to keep an overview while designing on technology, PSS and social business plan in synch. To achieve these objectives, a set of tools is given to the participant: Braindrawing and How-tos enquiring (Tassoul,2006), design drawing, storytelling and Tecdoc (Bertone & Wiebe, 2002), DIY material receipt (Ayala Garcia, 2019) and DIY digital technology tools and instruction, local context social need analysis, stakeholder mapping and analysis and social business model canvas (Joyce and Paquin, 2016).

ST4S APPROACHES ST4S INNOVATION PROCESS ST4S WS STEPS

Social-Tech
elements
[Ismail et al., 2012]

Place-based
[Rissola et al., 2017]

Design for
product innovation
[Roozengurg & Eekels, 1995]

[Figure 1] *ST4S Innovation process and workshop steps*

2.3. THE TAMBALI FII ST4S WORKSHOP AND RESULTS

The ST4S workshop methodology and innovation process were tested during the experimental phase of Tambali Fii project to design new PSS strategies for the whole local fishery and supply chain strengthening. The fishing market is one of the main economic drivers of the Senegalese economy. However, this sector fails to create attractive opportunities for its young population suffering from a traditional and risky fishing approach, and a foreign companies competition operating with modern and well-equipped deep-sea fishing vessels. This competition at sea is also accentuated by the lack of appropriate storage and refrigeration equipment, making promptly consistent the waste of products.

The workshop was addressed to these challenges aiming at creating innovative long-term strategies for technological and social entrepreneurial solutions and at training students on social entrepreneurship and design for social and technological sustainability. The activity was developed involving 15 students of the 1st and 2nd year of the architecture and civil engineering master degree at IPP-Dakar for three weeks. The work period and tasks were split into sections, and the students were divided into five different mixed groups. These give a rhythm to the design activity, allowing the organisation to verify time and tasks, and meeting efficiency according to the ST4S workshop methodology and innovation process. The workshop sections are following described.

INTRODUCTIVE LECTURES & TOOLS EXPLORATION [collective - 7 days]: Introduction, individuation of the main workshop drivers; division of the participant into groups [3 hours]; case studies [3 hours]; place-based

approach for design and tools [3 hours], yacht design principles and methods [3 hours]; DIY digital techniques and tools [9 hours]; DIY Materials approach [3 hours]; DIY Material case studies and tools [6 hours]; Social business entrepreneurship and tools [9 hours]; social business entrepreneurship case studies [3 hours].

IDEA FUNDING [in groups – 4 days]: context and local challenges analysis, and social needs [6 hours]; PSS generation loops through Braindrawing and How-tos enquiring answering the local challenges identified [6 hours], PSS strategy selection [3 hours] and description with storytelling tools [3hours]; analysis of the resources and technological requirements [6hours].

PLAN DEVELOPMENT [in groups – 7 days]: overlap activities of product and service design planning development [12 hours], production planning development [12 hours] and social business pan development [12 hours]. The final phase is the presentation of the PSS plan to the involved community of students, professor, and stakeholders, through visual representation and speaking presentation [6 hours].

During the Tambali Fii ST4S workshop, the students developed 5 PSS projects and related social business plan facing at local fishing sector challenges. Between them, the transportable maintenance platform for pirogues envisages a new product-service system addressed to the local fishermen's associations that easy the hauling and launching of a traditional fishing boat. The platform can be adapted to the different vessel bodies and used from different vessel owner. Furthermore, it could also be employed as a station for the ordinary maintenance on the seaside. Another project, the "Pirogue Balancier modulable", uses the plastic waste as raw material to build new 3D printed balancing equipment for pirogues. This project faces two of the main societal problem of the fishing sector in Senegal: onboard safety and plastic pollution in the marine ecosystem. The project proposes the use of the DIY "Plastic Fantastic" tools for plastic material recycling and 3d printing filament production in order to additive manufacture custom and modular balancing arms. These arms contribute to stabilizing the traditional fishing boats during the nets handover avoiding vessel capsize. A third project is addressed to the fisheries conservation and transportation chain. Due to the scarce availability of onboard refrigerate containers, the waste of fishing products is consistent. The "Hi Tadji" project designs a new double layer fish container that can be filled by ice in slot box. This box is at the centre of all the conservation and transportation operational chain. Thanks to the modular feature of the container and to the 3d printed handle and hermetic latch, fishers can place more than twenty boxes on a single pirogue, balancing the weight and stabilizing them while filling. Once landed, the boxes can be used to transport fishes to the local market avoiding the contact of the fishery with soil and sand. The business model defined the propriety of the boxes to the local fishery market association renting them to fishers in the form of service and providing maintenance and substitution. This PSS model ensures a better quality of market hygiene and food conservation. Furthermore, it reduces the transportation time from vessel to market and the cost of product waste.

3. RESULTS, DISCUSSION AND FURTHER DEVELOPMENTS

In order to validate the results of the ST4S workshops, a series of semi-structured interviews was conducted to a sample of four students, two local professors from IPP-Dakar and two professors from the Politecnico of Milan also interviewed a local entrepreneur involved in the Tambali Fii Project for technological support. The interviews covered four main themes: (i) the perceived relationship between new technologies and the societal challenges in Senegal, (ii) the perceived satisfaction and (iii) efficacy of the ST4S workshop and (iv) the perceptions about the development of social entrepreneurial forms in Senegal. Students' interviews revealed a strong appreciation for the ST4S workshop and its interdisciplinary approach. Students appeared to have particularly enjoyed the emphasis on the interlink between new technologies as 3D printing or DIY materials and social entrepreneurial opportunities. This particular appreciation, coupled to the development of the social business model, may be read as a validation of the educational model, coherent with Rognoli et al. (2015) and Schonwetter and Van De Viele (2018). The social entrepreneurial opportunities are perceived as being capable of tackling local societal challenges as the heavy coastal plastic pollution present in Dakar and low productivity of the fishing sector.

Students appear to have strongly improved knowledge about entrepreneurial skills, and they started perceiving entrepreneurial careers as a potential outcome for their studies. Nonetheless, students' interviews also highlighted a well-founded awareness about the difficulties in introducing new social entrepreneurial forms in the local economic system, which does not appear ready to a deep change in its entrepreneurial models. This perception is also confirmed by the other local interviewees who, despite stressing the potential of social entrepreneurial forms, underline many systemic and cultural obstacles to the development of social business in the Dakar context, mainly because of the difficulties in recognizing the economic opportunities in responding to socio-environmental challenges.

However, also due to this strong understanding, both the local and the foreign interviewees underline the value of education in social entrepreneurship and sustainability. Respondents suggest that the design of entrepreneurial

educational programs founded on social and environmental challenges should be improved and also diffused at lower educational levels and with greater continuity. Interviewees suggest the necessity to apply the theoretical model about social-tech entrepreneurship also in a different context from that of traditional fishing which displays highly settled business models. Actually, in sectors displaying a higher propensity to innovation social entrepreneurial education appear to display a greater potential. Moreover, interviews also stressed the importance of maintaining a place-based approach in this typology of education, creating educational models able to be tailored to local contexts and local societal needs, involving local communities.

Overall, both students projects and validation interviews highlight the potential of education in social-tech entrepreneurship, founded on a place-based approach, in order to foster social-tech entrepreneurship as a key player in innovation ecosystems, also in BOP countries. The results also stress the necessity to deepen research about educational programs merging technology and social entrepreneurship, to collect best practices in this field and to elicit the construction of more systematic models which could also be extended also to students at different educational level and applied in different sectors and contexts.

BIBLIOGRAPHY

Al Taji, F. N. A., & Bengo, I. (2018). The Distinctive Managerial Challenges of Hybrid Organizations: Which Skills are Required?. Journal of Social Entrepreneurship, 1-18.

Arena, M., Bengo, I., Calderini, M., & Chiodo, V. (2018). Unlocking finance for social tech start-ups: Is there a new opportunity space?. Technological Forecasting and Social Change, 127, 154-165.

Bertone, G.R., and Wiebe, E.N. (2002). Technical Graphics Communication. Blacklick, OH: McGraw-Hill College.

Dzombak, R., Mouakkad, S., & Mehta, K. (2016). Motivations of Women Participating in a Technology-Based Social Entrepreneurship Program. Advances in Engineering Education, 5(1), 1.

Elmes, M. B., Jiusto, S., Whiteman, G., Hersh, R., & Guthey, G. T. (2012). Teaching social entrepreneurship and innovation from the perspective of place and place making. Academy of Management Learning & Education, 11(4), 533-554.

Ismail, K., Sohel, M. H., & Ayuniza, U. N. (2012). Technology social venture: A new genre of social entrepreneurship?. Procedia-Social and Behavioral Sciences, 40, 429-434.

Jackson, D. J. (2011). What is an innovation ecosystem. National Science Foundation, 1.

Joyce, A., & Paquin, R. L. (2016). The triple layered business model canvas: A tool to design more sustainable business models. Journal of Cleaner Production, 135, 1474-1486.

Mazzei, M. (2017). Understanding difference: The importance of 'place' in the shaping of local social economies. VOLUNTAS: International Journal of Voluntary and Nonprofit Organizations, 28(6), 2763-2784.

Oksanen, K., & Hautamäki, A. (2014). Transforming regions into innovation ecosystems: A model for renewing local industrial structures. The Innovation Journal, 19(2), 1.

Pache, A. C., & Chowdhury, I. (2012). Social entrepreneurs as institutionally embedded entrepreneurs: Toward a new model of social entrepreneurship education. Academy of Management Learning & Education, 11(3), 494-510.

Rissola, G., Hervã, F., Slavcheva, M., & Jonkers, K. (2017). Place-Based Innovation Ecosystems: Espoo Innovation Garden and Aalto University (Finland) (No. JRC106122). Joint Research Centre (Seville site).

Rognoli, V., Ayala Garcia, C., & Bengo, I. (2017). DIY-Materials as Enabling Agents of Innovative Social Practices and Future Social Business. Forma 2017 (pp. 1-9). CUB.

Roozenburg, N., & Eekels, J. (1995). Product Design and Structure Methods. Wiley.

Schonwetter, T., & Van Wiele, B. 3D Printing: Enabler of Social Entrepreneurship in Africa? The Roles of FabLabs and Low-Cost 3D Printers. OpenAIR – African Innovation Research, Working Paper 18.

Smith, W. K., Besharov, M. L., Wessels, A. K., & Chertok, M. (2012). A paradoxical leadership model for social entrepreneurs: Challenges, leadership skills, and pedagogical tools for managing social and commercial demands. Academy of Management Learning & Education, 11(3), 463-478.

Surie, G. (2017). Creating the innovation ecosystem for renewable energy via social entrepreneurship: Insights from India. Technological Forecasting and Social Change, 121, 184-195.

Tassoul, M. (2006). Creativity Facilitation, a Delft Approach. VSSD Delft