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Enhancing Open Innovation: The Co-Creation of an Open Innovation Toolkit

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ABSTRACT

The aim of this paper is to explore and describe a methodology for collecting and reviewing tools and methods of open innovation that can be used to integrate and operationalize the involved stakeholders in processes of open innovation development. The authors originally realized this by applying a Quadruple Helix (QH) Model of innovation, which recognizes four major actors in the innovation system: science, policy, industry, and society, to the development of an Open Innovation Toolkit (OIT). Specifically, the actors were involved in the development or implementation of health and welfare' technology aimed at older adults. The result of this paper is an outline of the methodology used for implementing the OIT, and involving QH actors in the process.

Keywords: Open innovation toolkit (OIT), Open innovation, Older adults, Co-creation approach

INTRODUCTION

Demographic developments across the world, such as the gradual aging of the world's population, are increasing demands on health and welfare technology developed for tasks relating to the care of older adults (United Nations, 2019). Furthermore, the European "silver economy", understood as the purchasing power of persons aged 55 and older, is now the third-largest economy in the world, only surpassed by the economies of China and the United States (US) (European Commission, 2018). Thus, developers have increased their focus on creating technology for this target group. However, throughout the Interreg Baltic Sea Region (BSR) project OSIRIS, many stakeholders saw technology as seemingly being developed in a vacuum, without the inclusion of the end-users in the developmental phases and often without the involvement of any other stakeholders, such as academics or policy makers. Developers, on the other hand, have expressed hardships and difficulties when trying to include such stakeholders, lacking specific frameworks for doing so beyond regular customer satisfaction tools or user tests. The gravity of these gaps is also identified and highlighted in the United Nation's (UN) *Decade of Healthy Ageing (2021–2030)*, which aims to bring together governments, civil society, international agencies, academia,

the media, the private sector, and other stakeholders to foster healthy aging and improve the lives of older adults (World Health Organization [WHO], 2021). Such international collaboration would encourage effective knowledge co-creation, sharing, and usage, which are important factors of open innovation, providing the potential for new technological development that might address the challenges of population aging. Therefore, at both the regional and transnational levels, there is a strong need for an Open Innovation Toolkit (OIT) that incorporates innovation development tools and methodologies to serve all stakeholders in different stages of innovative development processes. Furthermore, such tools must focus on collaborative processes.

Thus, the aim of this article is to investigate and present the co-creation process of structuring an OIT, which is a practical framework for fostering technological innovations and their market uptake to enable older adults to continue their lives with health, dignity, and independence. Specifically, the authors explore the integration of meaningful tools and methodologies that can be used by stakeholders or actors involved in processes of open innovation development. These innovation actors—such as research and business organizations, public and private service providers in social welfare and healthcare, financers and local policy-makers, as well as associations of older adults or end users—represent a Quadruple Helix (QH) innovation framework (Arnkil et al., 2010), occupying various roles. This exploration took place while the co-creation process between expert working groups from six countries in the Baltic Sea region was implemented within the framework of the OSIRIS Interreg BSR project.

This article seeks to contribute to the existing body of literature on open innovation by extending the understanding of how an OIT can be structured through the integration of relevant tools and methodologies and the application of a co-creation approach. We seek to emphasize how such a co-creation approach might further allow us to "practice what we preach" by involving all four QH stakeholder groups in the methodological process. The selected tools range from relatively simplistic tools for conducting surveys with customers or stakeholders to complex methodologies for conducting entire design processes. Moreover, the OIT was created with the hope of bettering the premises for inclusion of QH stakeholders in innovation processes, with an emphasis on end-user involvement. In turn, the aim is to enhance sustainable, technological development in the future, by supporting such processes.

This article is organized as follows: The next section introduces an overview of the theoretical background, based in current literature, as well as concepts like open innovation. The methodological application of the co-creation approach applied in the structuring process of the OIT then follows. Additionally, we present the grounds for our review and the basis for tool assessment. After, follows a section describing and discussing the implementation of the proposed OIT structure, including potential practical applications and the ways that QH actors were involved in the development. The final section discusses contributions and limitations and proposes potential further research.

Theoretical background

In recent years, the term "open innovation ecosystem" has been increasingly used in both scientific and practical contexts (Hartmann & Trott, 2009; Visscher, Hahn, & Konrad, 2021; Walrave, 2018; Fasnacht, 2018). This reflects a growing interest in and awareness of how organizations and activities influence processes of innovation and how important partnerships are to the production, acceleration, and accumulation of knowledge, innovation, and growth (Fasnach, 2018). Ecosystems are often mentioned in connection with business models, platforms, collaborations, multifaceted markets, networks, technology systems, supply chains, and value networks (Kitsios et al., 2017; Lindgren & Bandsholm, 2016). The concept of open innovation ecosystems is modeled with a focus on value creation and refers to the involvement of various innovation actors representing different perspectives, organizations, and institutions collaborating in innovative development activities (Fasnach, 2018).

The term "open innovation" is far from new. Coined by Henry Chesbrough in 2003, it originally placed a strong emphasis on research and development. Chesbrough defined it as the operationalization of internal and external ideas, in combination with both internal and external paths to market, with the aim being to advance technological development (2003). The term still strongly emphasizes openness regarding information, rather than secrecy, which might often connote ideas of corporate research labs (i.e., Zemaitis, 2014; Fasnach, 2018). Newer perspectives on open innovation have an increased focus on knowledge as a relevant concept, providing insight into the internal and external sharing and especially management of knowledge (Bican et al., 2017; Weissenberger-Eibl & Hampel, 2021). Ecosystem, a term borrowed from biology, is used here to underline the ways systems are comprised of interwoven connections between actors who all influence one another to lesser or greater extents (Fasnacht, 2018). Collaboration across areas of expertise, as well as across world views and arenas, are at the heart of any open innovation ecosystem. Ecosystems can, based on relevance, be explored on a micro-level—investigating internal organizational resources—or on a macro-level—exploring larger social environments across institutions, practices, and potentially cultures (Meynhardt et al., 2016). This provides further reasoning for the addition of a QH approach to the open innovation process. Thus, open innovation ecosystems refer to the wider system(s) and collaboration between stakeholders in innovative processes. For example, in the process of actualizing and analyzing the open innovation ecosystem, one might choose a point of departure stemming from the actors and their internal affiliations, hence exploring connections and processes (Visscher et al., 2021). Alternately, a process might originate in the value offer, afterward addressing the activities required to materialize value through the alignment of actors (Adner, 2017). In either case, the final goal will be capturing value. Regardless, such perspectives are highly relevant to us in the creation of a toolkit, with the main goal of enhancing and supporting innovation actors. The addition of the relevance of knowledge in relation to open innovation further underlines

the significance of all stakeholders within ecosystems such as those found in innovation.

A critique of the ecosystem concept is that it can be seen as a self-replicating, gradually evolving system where individual companies can only adapt. We assume however, that the ecosystem is dynamic, and the actors thus play a crucial role. Open innovation ecosystems are dynamic constructs, which can continually expand/contract and change. These undercurrents are not governed by internal systematic logic but are the result of the actions of various stakeholders, such as businesses, politicians, and/or researchers.

According to Huizingh (2011), the open innovation concept is attractive because it fits very well with many trends found in the broader management arena. Among the characteristics of open innovation is the encouragement of companies to use both internal and external ideas, as well as internal and external paths, to market as they upgrade their business models (Çubukcu & Gümüş, 2015). To survive in today's world, firms must therefore communicate with their external environments, such as the global market, trends within given industries, and competitors' products. Collaboration and cooperation are therefore important aspects at all stages of the innovation process. In this regard, the innovation process involves four main steps: ideating, designing/creating, going to market, and scaling up (Tohidi & Jabbari, 2012). To maintain their competitive advantage, enterprises cannot rely exclusively on their own research, ideas, and resources. The process of drawing on external knowledge and expertise can, however, be a daunting task for any stakeholder without strong affiliation to a larger corporation. Such stakeholders might include Small and medium-sized enterprises (SMEs), actors within academia, policy makers, citizen organizations, or simply innovative individuals within civil society. This is among the main reasons why open innovation tools should be part of any innovation process within companies, governments, and universities or in relation to the users themselves. Such tools might provide scaffolding on which stakeholders can "stand" when viewing and making use of the open innovation ecosystem. Overviews of tools have been produced before. Bocken et al. (2019) conducted an overview of Circular Business Model Innovation Tools. They found that contemporary technologies are available for all generic phases of innovation, including ideation and design, implementation and testing, and evaluation and improvement. The majority of studies, however, were semi-qualitative and focused on the brainstorming and design phases. This revealed the need for more quantitative tools, as well as technologies that assist at all phases of the innovation process. Furthermore, more multidisciplinary approaches that integrate the domains of business, design, engineering, and sustainability sciences were identified as necessary (Bocken et al., 2019). The production and development of a toolkit, therefore, should focus on usability for all four helices; more importantly, the tools—especially the toolkit—must be comprehensible to all stakeholders. Often the processes of and tools for innovation are technically complex and beyond the reach of lay stakeholders in particular.

METHODOLOGICAL APPLICATION IN STRUCTURING AN OIT

The purpose of this section is to present the methods used for capitalizing on the collective creativity of expert working groups from six countries in the Baltic Sea region during the OSIRIS Interreg BSR project in autumn 2020. The main empirical data was collected through a scoping review and additional review of literature on tools and methodologies. Furthermore, the tools and methodologies under scrutiny were required to support the processes of open innovation development in the contexts of health and welfare technology, thus addressing the challenges of population aging.

Systematic searches were conducted in the following databases: Academic Search Premier; Business Source Premier; Library, Information Science & Technology Abstracts; EBSCO Q&D; Scopus; Socindex; Web of Science; and ProQuest–Engineering. The findings were further supplemented by Google Scholar. We created several search strings and used a block strategy for searching based on each of our created search matrices (Lund et al., 2014). Where possible, we conducted thesaurus searches; where this was not possible, we searched for TT/Abstract/AU-Keyword/AU-Abstract and Other Term. Strings were adapted to the individual databases, and we made use of truncation to account for multiple ways of indexing the terms used in different databases. The collection of searches (excluding wide searches with few parameters) yielded 218 results, after the removal of duplicates. From those results, we selected 32 articles introducing tools and methodologies applicable to open innovation development processes. Consistent with accepted practice for scoping reviews, we did not appraise the quality of the methodology nor risk of bias of the included articles (Arksey & O'Malley, 2005).

After the systematic searches, we further developed a joint methodology for assessment, review, testing, and end-user involvement. During this process, a collective of 17 experts selected 12 articles portraying either tools or methodologies from 32 articles deemed relevant for the OIT. The experts later reviewed, tested, presented, and validated all 12 tools or methodologies, deeming a few irrelevant along the way. Accordingly, the initial assessment stage included combining the results of the scoping review with methods of co-creation between transnational and cross-disciplinary joint working groups. To succeed in this joint explorative and analytical work, we set up a systematic methodological framework for assessing and validating tools and methodologies identified through the scoping review. As such, the initial assessment of the 32 articles by the experts was based on the following five main prompts: 1) Is the tool/methodology relevant to our perspective on technological developments addressing challenges of aging populations? 2) How easy would it be to implement the tool/methodology for use in innovation process(es)? 3) To what extent, is a focus on innovation embedded in the tool/methodology? 4) How easily could innovation actors put the tool/methodology to use? 5) What is your general quality assessment of the tool/methodology? All assessments were then analyzed, categorized, and given three scores for each of the above-mentioned parameters: (1) observed minimum score, (2) observed maximum score, and (3) average score across all

experts. The maximum score was scaled to 10.00, providing a more detailed average than a five-point scale. The first four parameters (relevance, applicability, focus on innovation, and usability) of the assessments were grouped in a "combined result" category that served as a mean score of the four parameters. The fifth, general assessment category was kept analyzed separately, as it represented the overall quality assessment of each expert group and provided an overview of the overall academic quality of the selected articles.

After the overall assessment, the aforementioned 12 articles were selected based on the combination of best scores within the two main categories (combined results and general assessment). Only articles rated higher than an 8 out of 10 in the average score was selected for further review. The list of the highest-rated tools was distributed among the expert groups for further review, testing, and validation. Each expert group was provided with two tools or methodologies to review. Additionally, the experts were free to add and review additional literature on relevant tools or methodologies if they deemed it necessary.

To ensure a common basis for further review, all expert groups adhered to a seven-page review template asking them to provide the following: 1) an overall presentation of the article; 2) the disciplinary and theoretical position of the article; 3) the terminology and concept used in the article; 4) the academic quality of the article; 5) a review of the research methodology (if any); 6) a presentation of the tool/methodology; 7) a presentation and review of the premise of the tool/methodology; 8) prospective uses for the tool/methodology; and 9) a critique of the tool/methodology. The template was constructed to be used within the expert group, as well as among QH stakeholders to engage them in further review of the selected tools and methodologies and the co-creation process of structuring the OIT. As a result, eight tools and methodologies were selected for further presentation and validation and placed within the initial OIT framework, which was structured in the form of a four-by-four matrix. The matrix columns include the following innovation development stages that were identified by experts: *discovering & ideation, designing & prototyping, assessing & going to market, and scaling up & networking*; the four groups of QH innovation actors occupy the rows of the matrix.

The continued co-creation process included the conduction of three innovation camps, which involved representatives from all QH actor groups. During the innovation camps, representatives of private businesses were coupled with older adults or end users, policy makers, and members of academia to explore the final tools and methodologies selected for the OIT, as well as to validate its structure. Furthermore, the aim was to engage all QH innovation actors in the co-creation process.

In summary, the final OIT structure underwent several rounds of both internal and external validation, including explorations of design and content, with representatives of all QH actor groups. Importantly, end users of health and welfare technology were involved in all stages of the co-creation processes with great benefit to the academical stakeholders and private businesses, who gained valuable insights into open innovation development.

IMPLEMENTATION OF THE OIT

Based on the co-creation processes outlined above, an initial basis of five main tools or methodologies was selected for and implemented in the final OIT. These tools and methodologies included the following: Design Thinking, the SOSI-tool, the Harmonization Cube, the House of Quality, and the Eco System Pie Model. The five main tools were further supplemented with 25 tools for collecting qualitative data. These quantitative tools were further divided into the following categories: survey tools (7), community feedback tools (3), voice-of-the-customer tools (6), online review tools (4), user testing tools (3), and visual feedback tools (2). All tools and methodologies had previously been assessed in terms of their usability by different QH stakeholders. The assessment was founded in the aforementioned matrix, enabling stakeholders to locate a tool or methodology related to a specific need they currently have or to explore the various themes (discovering & ideation, designing & prototyping, assessing & going to market, and scaling up & networking) or the stakeholder groups they represent (business, policy making, academia, or civil society).

In the spirit of open innovation, the OIT is a dynamic toolkit, and thus open to further development wherein any relevant open innovation development tools and methodologies are easily applied. The OIT is available on the SilverHub digital platform (https://silverhub.eu/).

The practical application of a variety of methods used for developing the OIT might be relevant to stakeholders either trying to iterate innovative processes or establish innovative contexts, where involvement by several different stakeholders is deemed relevant. The combination of such a co-creation methodology and a quadruple helix innovation system could further technological development for an aging world population in a more effective and prudent way by providing end users with a voice in innovation processes that both betters the final outcomes of specific technologies and the opportunities of private businesses developing technologies, as they are less likely to end their developmental processes with disused products.

CONCLUSION

The tremendous potential of focusing on technological development in the face of a potential demographical crisis must be accompanied by sustainable and open innovative processes. Such processes involve the entirety of an open innovation ecosystem from end user to policy maker, academic, and developer. Through the use of tools relevant to open innovation, stakeholders might, to an increased extent, be able to adhere to the development, implementation, exploration, and purchase of products that have been collaboratively developed with and for older adults, for whom the effects of the demographic development would be greatest. Further development and collection of such tools is, however, needed.

The main result of this paper is therefore not the specific OIT produced by the joint expert groups but rather the co-creation methodology, which was designed and implemented through the following stages: locating and distributing, initial assessment, review, description, dissemination and validation,

and engagement with all QH innovation actors in the open innovation development process. There are clear advantages to the way we engineered the engagement of all stakeholders in the co-creation process. The knowledge gained throughout the entire process, as well as the results, would have been substantially different without the involvement of all QH innovation actors, likely making the toolkit far less usable and relevant to any if not all stakeholders for whom it was produced. The authors hope that such a "practice what you preach" methodology might be externalized in more theoretical frameworks relating to open innovation. The toolkit itself is being used actively by stakeholders, when either in need of a tool for a task or when performing a task but missing methodological frameworks. This was the aim of producing the toolkit, thus promoting the work of other stakeholders while simultaneously enhancing and supporting open innovation processes as a stakeholder within the ecosystem(s).

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