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Article

Enablers of Open Innovation in Software Development Micro-Organization

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Abstract: The implementation of the open innovation (OI) model is associated with a significant organizational change within the existing processes, business models, and prevailing customs. This change takes appropriate measures to prepare for and conduct an effective implementation process. Only a small number of research concerns software development micro-organizations using the OI model. Therefore, this article focuses on defining and systematizing the activities supporting the implementation of OI, which are initiated depending on the implementation process and the organizational level at which a given process is implemented. The research was carried out based on a case study in the Sandstream Development Sp. z o. o. (SSD) organization by analyzing the approach to the implementation of the Sandtime.io project. As a result of the undertaken research effort, the assumed research goal and a theoretical model of implementing open innovations in software development micro-organizations were developed. In addition, the importance of preparing the foundation for the OI model was also emphasized through the recommendations for managers regarding the implementation of individual implementation activities.

Keywords: project management; open innovation; competitive advantage; semi-open-source product; capacity for internal innovation; culture and values



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1. Introduction

The 21st century, marked by a turbulent business environment [1–4], led to companies finding it necessary to use external sources of technology [5,6] and knowledge [7,8] to build a competitive advantage [9–11] and to intensify their internal R&D [12]. As emphasized by many authors [13–17], innovation then became one of the driving forces of economic development [18], thus building the success [19] and strategic uncertainty of enterprises [20]. Both these factors contribute to increasing cooperation between business and scientific circles [21–23]. The concept of open innovation (OI) popularized by Chesbrough [24] has led to the wide development of exploratory research [25,26], as discussed in many economic areas [1,15,16]. Moreover, as Munir et al. [27] emphasized, organizations are forced to use the experience, knowledge, and opportunities outside their walls. The paradigm of open innovation through a holistic approach to the strategy emphasizes the simultaneous fulfillment of three fundamental aspects. Firstly, it refers to the systematic search for and taking advantage of various sources of innovation opportunities with commercial potential [28]. Secondly, it indicates conscious activities aimed at integrating the identified sources of innovation opportunities with the internal and external potential of the organization [27]. Thirdly, it emphasizes the use of multiple channels to develop, improve, and seize selected opportunities for innovation [17].

Open-Source Software (OSS) was developed before Chesbrough popularized the OI paradigm [27]. Moreover, OSS is now a common example of OI used by software development companies [29]. As emphasized by the authors [27–29], through the use of external

resources and knowledge transfer, OSS increased not only innovation but also the quality of the product while shortening the time of introducing it to the market. However, as noted by Linåker et al. [30], product innovations trigger process, business, and organizational innovations, not the other way around. Moreover, the authors also showed a complex correlation between the types of innovation. Considering the above, software development organizations that want to increase their competitive advantage by using the OI model must take advantage of opportunities for innovation at the product and process level and business and organizational changes. As Munir et al. [27] emphasized, programming organizations must adapt and modernize their internal strategies and processes at the software development level and the enterprise's operation.

In the references on the subject of open innovation, there is much evidence confirming the positive impact of OI on the achieved results. For example, Crema et al. [31], while conducting research among 107 SMEs of Italian enterprises, observed that the increase in the efficiency of the enterprise, measured as sales volume and return on capital, was influenced by open innovation combined with the use of internal competencies. Similar observations were made by Hameed et al. [32] researching SME management staff in Malaysia. The authors found that the transfer of external knowledge and the maximization of internal innovation positively moderated the performance of enterprises in terms of OI. The above is also confirmed by studies conducted by Ranguis et al. [33], including six Slovenian companies.

What is more, the authors observed that the motivator for the involvement of enterprises in the OI process is the expectation of results in the form of faster development, lower costs, and improved competitive advantage. However, as Ehls [34] and Kohler et al. [35] pointed out, the use of OI does not always reduce the level of risk or failure rate of new products. Moreover, there is not always a business case for using OI, as the cost of implementing and maintaining such a model may sometimes not justify its benefits [36,37].

As emphasized by the authors [38–40], for a company to achieve the expected benefits from products (especially in terms of competitive advantage), it must first focus on the required processes. Therefore, the enterprise must mature to determine the appropriate approach to OI. Moreover, as Munir [27] notes, the existing literature does not sufficiently research the issue, including examples of organizing or performing individual activities supporting the implementation of open innovations in the field of OSS, which, on the one hand, can play a supporting role for the further escalation of internal innovations [29], and on the other, build the competitive advantage of the enterprise. Moreover, only a small number of research concerns software development micro-organizations using the OI model.

This article focuses on filling the identified knowledge gap in the scope of defining enablers supporting the implementation of open innovations using OSS solutions in software development micro-companies. The research was carried out based on a case study in the Sandstream Development Sp. z o. o. (SSD) organization by analyzing the approach to the implementation of the Sandtime.io project.

The construct of this article is divided into four main sections. Section 2 presents related works on the determinants of open innovation in this area, while Section 3 covers the research approach adopted. Subsequently, Sections 4 and 5 present a case study and a discussion focusing on the identified determinants. Finally, Section 6 summarizes the article and indicates recommendations for further research.

2. Theoretical Background

The following section summarizes the related work on the process of implementing open innovations, plans covering the level of organization, project management, and stakeholders, as well as determinants supporting the implementation of open innovations. The conclusions from the literature analysis provide evidence for the need to conduct research at the meeting point of the dimensions mentioned above in terms of defining and

systematizing activities supporting the implementation of open innovations in software development micro-organizations.

2.1. OI Implementation

The implementation of the open innovation model involves a significant organizational change in the company [41], both within existing processes [9] and values or culture [42]. The literature on the subject includes various multi-phase models describing the process change of an organization. These models range from three classical phases described by Lewin [43] to twelve phases [44]. However, as suggested by Chiaroni et al. [41], open innovation as a process of organizational change takes place through unfreezing—moving—institutionalizing sequence, thus emphasizing the originality of Lewin's three-phase model. The first phase of the model involves creating a sense of urgency for change and creating and communicating visions to internal and external stakeholders. As pointed out by Zynga et al. [45], in this phase, managers suggest the need to open the innovation process and use various sources of access to external knowledge. The second phase includes implementing specific changes by establishing new patterns, procedures, or behaviors corresponding to a specific vision and setting strategic goals [46]. In this phase of OI, enterprises build organizational understanding while experimenting with new methods [41,45].

Moreover, as Trzeciak et al. [47] emphasized, these activities should be thought out and coordinated at the organization's strategic level and carried out as a set of program projects with greater overall benefits. The above is also recommended by Chiaroni et al. [41], postulating that the implementation of OI should be well thought out and carried out in the form of a multi-stage change. In the third phase, the organization validates, consolidates, and standardizes the improvements achieved in the previous phase while preventing a recovery [47]. In the scope of OI implementation, the above comes down to establishing in the organization open forms of knowledge transfer [45,48] and cooperation with the environment as a permanent tool for ensuring and maintaining innovative abilities [47].

2.2. Open Innovation Levels

The first level of research on OI is the level of organization. Effective implementation of open innovation requires the organization of activities on many levels, which directly or indirectly determine the process of change [49]. As Munir et al. [29] emphasized, the intensification of the implementation of open innovations makes it necessary to secure a competitive advantage, especially against software development organizations. The above is related not only to the aspect of product selection while maintaining differentiation in relation to the competition [50] but also to the time of its publication and the integrity of internal processes [39,51]. Moreover, involvement in the community or developing an organization's OSS can also generate significant problems [27]. For example, they can be manifested in the scope of protection of property rights [52], high investment costs [53], or the involvement of own employees [54]. In addition to the success factors [55] and threats [56] resulting from the implementation of OI in organizations, the literature on the subject highlights the nature of business models [9,57] or organizational structures [58]. As Turoń emphasized, without an appropriate model and process approach, organizations are less effective at creating value [9]. The authors also confirmed the above [59–62], stating that the effective implementation of OI is related to the appropriate adjustment of the business model and the definition of limitations and moderators of the entire process within the organization. Also, as emphasized by Enkel et al. [63], open business models also define the "desired final state of company transformation".

Although there is a significant intensification of research in OI [13,14], they mainly refer to the organizational perspective [64]. As noted by Bagherzadeh et al. [64], to fully understand OI management, it is necessary to shift research to the level of projects, which are relatively scarce in the literature on the subject. The project management perspective is crucial for the appropriate implementation of open innovation models, especially in the IT industry, where both OSS and commercial products are accompanied by a high

degree of uncertainty and complexity. The above is motivated by several aspects. Firstly, project management builds an environment open to cooperation inside and outside the organization [65]. Secondly, it supports knowledge transfer at the organizational [66] and project implementation [67] levels. Thirdly, project management provides mechanisms for creating new values and managing change [68] or competencies of human resources [55]. Fourthly, the legitimacy of OI occurs when the organization has mechanisms to maintain the implementation capacity [55]. The authors [47] noted that OI and project management have common success factors. Moreover, as suggested by researchers [26], appropriate implementation of open innovation models should be implemented as a program coordinating a set of related projects while ensuring simultaneous implementation of mechanisms allowing for the strengthening of the introduced business change in the organization aimed at innovative openness [47,69].

Another level relevant to open innovation models is the stakeholder perspective. As Turoń [9] emphasized, in the case of software development, both OSS and any other digital service, the information about the value provided by the user is almost immediate. Both internal and external stakeholders play key roles in the concept of open innovation. Firstly, how the OI model includes the creation of a cooperation network [27,28], building relationships and commitment while jointly creating value, and absorbing knowledge [30–32]. Secondly, key roles involving scouts and gatekeepers are identified [70]. Scouts seek and identify new opportunities for the organization's development, and gatekeepers support and consolidate the dissemination of external knowledge and technology within the organization. Thirdly, the implementation of the OI model, apart from the adoption by the enterprise of a set of practices facilitating the internal and external transfer of knowledge [17], requires the integration of processes, competencies, and appropriate human resources. Moreover, these resources must be properly motivated and engaged in creating innovative products.

2.3. Enablers of OI Implementation

- Leadership, motivation, and engagement—including human capital [71], leadership skills at every level of the organization [55], and strengthening employee engagement by combining leadership and innovation [72].
- The capacity for internal innovation includes organizational structures and resources required for effective OI implementation [47]. The literature in this area primarily focuses on project and knowledge management [26] and technical competencies related to R&D [55].
- Collaboration network—includes competencies related to formal and informal recognition of stakeholders' needs [73] while building both internal (project) and external (organizational) cooperation networks [68].
- Knowledge management—focuses on the simultaneous acquisition and creation of new knowledge [5,67]. As emphasized by the authors [55], knowledge management in its appropriate building and dissemination is crucial for implementing OI.
- Culture and values—refers to the practices or principles prevailing in the organization, which may also influence the motivation [46], attitudes [45], or intentions of employees [55]. At the same time, attention should also be focused on the appropriate building of collaboration, coordination, and perception in the context of the organization's values and organizational culture.

3. Materials and Methods

The conclusions from the literature analysis provide evidence for the need to conduct research in the field of defining and systematizing activities supporting the implementation of open innovations in software development micro-organizations. Given the knowledge gap defined in this way, the article tries to answer the main research question: What activities supporting the implementation of OI are initiated depending on the implementation process and the organizational level at which a given function is carried out?

The cited theoretical framework defines the main parameters on three axes (Figure 1), along which the research process was developed.

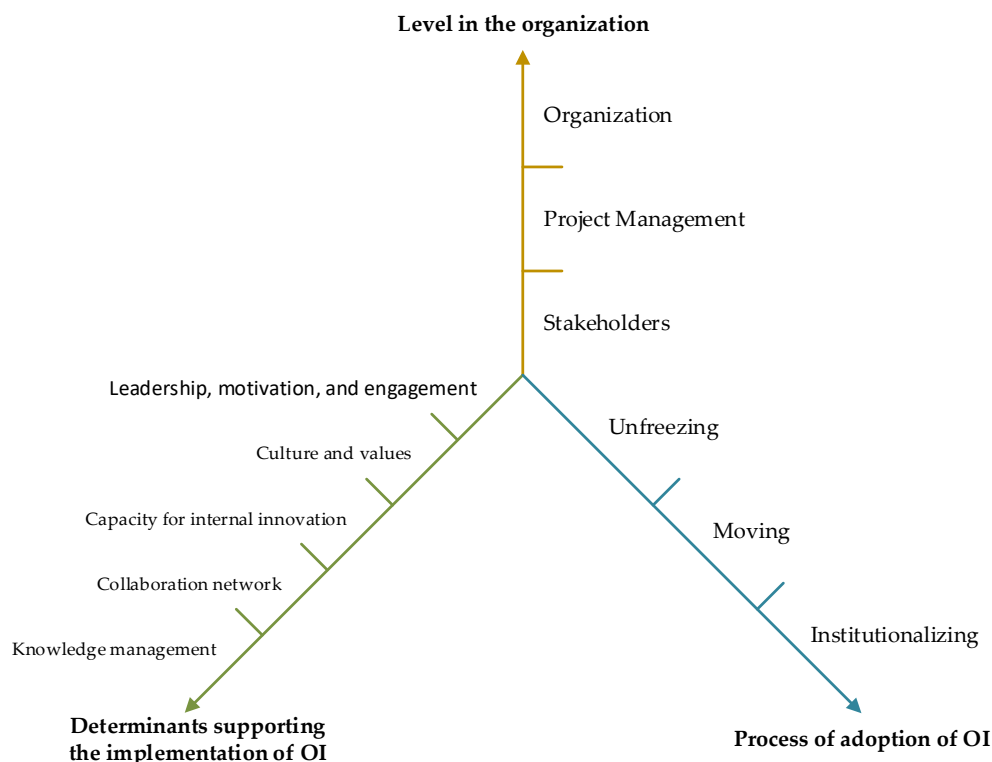


Figure 1. Summary of the three theoretical axes along which the research process was developed.

Given the scarce scientific exploration of software development micro-organizations, an inductive approach was adopted while focusing on a qualitative study involving a single-case study. As emphasized by the authors [74], designing a case study is particularly useful when the researcher develops a theoretical approach in a specific context. Moreover, to objectively describe the reality behind the adopted research problem, ethnography was used, characterized by the participation of one of the researchers in the entire analyzed process.

The case study covers a multi-aspect presentation of the current situation in a particular organization [75,76]. It is treated as an individual case that allows finding all necessary information that allows for an in-depth analysis, formulation of choice options, and making a decision with its justification [77]. It is worth noting that the goals of single-case studies are completely different from those of whole populations or their represented samples [78,79]. This method of selecting the research subject is defined as a deliberate selection or theoretical selection of a case on the basis of which the entire intellectual structure, model, and proposals for generalizations are created [80].

The above approach led to the exploration and interpretation of the adopted case study in the software development micro-organization of the Sandstream Development Sp. z o. o. company (SSD). The selection of the organization was based on several criteria. First, SSD is a micro-organization that currently employs ten people as part of a B2B cooperation. Second, SSD is an organization that provides web and mobile application development services. Third, the organization works in an agile model [81–83] characterized by the skills of cooperation, self-organization of team members, open communication, and creativity [84]. Fourth, SSD, to build a competitive advantage in 2020, implemented the open innovation model by creating a time tracking application (Sandtime.io), which is also semi-open-source software.

The collection and generalization of data were based on an in-depth analysis of activities undertaken by the selected organization within the framework of five determinants

supporting the implementation of OI. The researchers’ activities included participant observations throughout the development and implementation period of the application (Sandtime.io) and analysis of strategic documents, including strategic goals, key success indicators, performance indicators, and project documentation. Additionally, one of the researchers acted as the general manager of the selected organization, allowing for a general view, both from the operational and strategic levels of the organization.

4. Results

This section presents the scope of activities undertaken by Sandstream Development Sp. z o. o. company (SSD) both at the level of the organization, project, and individual stakeholders. The section is divided according to the adopted theoretical framework into five determinants supporting the implementation of open innovations.

4.1. Leadership, Motivation, and Engagement

The idea for the Sandtime.io time tracker arrived as an internal need of the Sandstream Development Sp. z o. o. company (SSD) and was strongly associated with the aim of tracking the time of the activities performed by the software development team. It was necessary due to business reasons to know the actual amount of time spent by each team member on the projects. The exact information was necessary due to two questions at the end of each month: “what is the expected cost for the customer?” and “What is the amount of payment for the subcontractors participating in the product development?”.

The SSD managers initially used one excel file for this purpose. After two years, the number of cross-referenced files increased from one spreadsheet to ten different files. The solution was working ineffectively. Each time managers wanted to add a new subcontractor, project, or even start a new year they were obligated to perform a substantial amount of work related to preparing and validating the excel files. It is essential to mention that after four years, the number of files used for time tracking within SSD increased to 45 different excel files strictly associated with timesheets and time control in the company. This made it very complex to keep the whole tracking system up to date.

In 2020, the SSD management decided to change the time control system. The company was growing, and the top management shared the strategic goals for the next ten years, described as five objectives (the list of objectives is shown in Table 1).

Table 1. Strategic objectives.

ID	Objective
OBJ1	We are increasing the company’s revenues through investment.
OBJ2	We create business products, commercial as well as open source that are very popular and massively visited (popular, new, innovative).
OBJ3	We are perceived as a special force software development company, so anybody knows that we can do everything because we know how to do it.
OBJ4	We know the right people—networking.
OBJ5	We are resilient and ordered according to our values, so we are not afraid of turbulence.

The strategical objectives were strongly associated with CSF (Critical Success Factors) as well as divided into KRI (Key Results Indicators) and ACT (activities associated with KRI).

It was an excellent opportunity to show the convergence of the idea for the Sandtime.io time tracking app developed by us, with the strategic company objectives 1, 2, and 5.

A team of experienced programmers, a tester, and one manager developed a project proposal that aligned with the strategic company objectives as follows:

- OBJ1: Sandtime.io time tracking app could be an investment, with expected return calculated not by the amount of earned money but by the qualitative differentiator from the competitors. It could be the first public product shown to further customers (the SSD was strongly limited to sharing the info about successes due to the nature of signed NDAs).

- OBJ2: The idea was to create a semi-open-source product that will combine open-source and internal safe solutions.
- OBJ5: Being ordered means having processes and procedures in place. Therefore, having a bespoke solution for time tracking used internally suits the objective very well.

The proposed idea was accepted and budgeted. All the originators of the idea were nominated to the Sandtime.io team.

4.2. Capacity for Internal Innovation

Sandtime.io was designed and developed in reference to the company strategy and the need to switch from the existing system (i.e., cross-referenced excel files). Due to that, from the very beginning, the SSD management planned to put some money into research and development related to modern technologies that could be used in the developed solutions. Because Sandtime.io is a collaborative tool, it was important to select and implement the best possible solution for:

- Access to the tool in real-time;
- Access to the instances of the same records by two and more users at the same time.

Initial plans considered spending a maximum of three months on developing and testing prototypes of the modern technologies, which was in line with OBJ1 from Table 1. Finally, these three months showed the company managers that R&D should be a part of the daily routine. It required a different approach to planning the product than was agreed upon before (initially, it was a waterfall approach).

Switching from waterfall planning to the more iterative model was not very hard. The Company has experience organizing software development in reference to many popular agile methods (e.g., Scrum, Kanban, XP). Those methods support research and development by their nature. Therefore, it was quite easy to ensure that OBJ2 would also be secured in development.

It was agreed that the whole project should cover software development and internal organizational changes. For instance, related to the onboarding process, the culture of reporting time, and sharing the results with customers. All of these secure OBJ5.

4.3. Collaboration Network

From the beginning, it was decided to create a project-oriented environment organized as a collaborative network. Therefore, none of the project team members was hired on a regular basis (i.e., regular employment). All the subcontractors, supporting officers, and the president of the SSD company were contracted. Such an approach has significant advantages for regular basis employment. The biggest value is the flexibility of assignments. The country where most team members live limits the possibilities of switching job positions, periods for re-employment, and stuff like that. In the case of internal products like Sandtime.io and the non-regular assignment related to the availability of free-to-utilize resources (i.e., a bench of engineers), this was the must-have.

Additionally, with the free-of-employment approach, SSD secured that each collaborating entity (e.g., software developers, testers, analytics, managers) could provide services to Sandtime.io and simultaneously participate in other projects even outside of the SSD company. All the persons participating in Sandtime.io development were aware of this approach. It allowed for corporate quality to be retained without its drawbacks.

Referring to SSD's internal slogan, "We strongly believe that a happy subcontractor is the one who will bring us the possibility to cooperate with other great talents", the biggest challenge for the companies like SSD was and still is to keep the best talent on board. Therefore, it was decided that working with SSD should be as good as possible. To keep the satisfaction at a high level, the managers of SSD decided to introduce a couple of rules that helped Sandtime.io become what it is now.

A network like this one required a leader. It is natural that the leader for this product should be the SSD company. From the beginning, the managerial team put a massive effort into providing direction and guidance to the individuals and teams. Therefore, it was

decided to choose and apply appropriate management styles in different situations. SSD management strongly believed that enabling individuals to lead, provide directions and motivate others is a key success factor for enhancing individual and team performance. The top management of SSD was aware of different leadership styles. Therefore, all leaders used appropriate leadership styles for the nature of team members' duties and personal characteristics. From the SSD perspective, leadership is essential for the whole life cycle of the project. Different needs are fulfilled for the top management, as well as for the development team.

4.4. Knowledge Management

The whole project would not exist without transferring the knowledge from the open-source community and subcontractors. Therefore, it was decided to perform several actions on the SSD level to support knowledge gathering, storage, organizing, distribution, and use. It was agreed that the good practices collected during the product development should be shared with others.

Gathering data about the product:

- Google analytics;
- Internal gamification feature;
- Comments on mobile app stores;
- Internal chat;
- Sprint planning, review, and retrospective meetings;
- GitHub comments and commits.

Gathering data about the development process:

- GitHub statistics and reports;
- Jira Software;
- Internal slack communicator;
- Daily meetings;
- Sprint planning and retrospective meetings.

Storage and organization data about the product:

- Sprint planning and daily meetings;
- On-demand 3-6-5 brainwriting sessions;
- Code review sessions.

Storage and organization data about the process:

- Sprint retrospective meetings;
- On-demand brainstorming sessions with other managers;
- Categorizing and prioritizing in reference to strategy;
- Internal library.

Distribution data about the product:

- Sandtime.io knowledge base (available online) [85];
- Roadmap on the landing page;
- Google Ads campaign;
- Partners portals (g2.com, youtube.com, facebook.com, capterra.com, etc.).

Distribution data about the process:

- Blog posts on medium.com;
- Whitepapers on the company page (e.g., "How we do it—software development process");
- GitHub pages.

Using knowledge (product and process):

- List of user stories in product backlog;
- Excel files;
- Roadmap on landing page;
- Plan for onboarding new team members.

The results mentioned above were used to develop new features, bug fix existing solutions, and develop internal processes (e.g., onboarding process) and strategies.

4.5. Culture and Values

The Sandtime.io project team members' values were associated with SSD culture and values. The SSD company is not limited to only one "golden" project management method. The proper approach is selected based on the real needs of the project. Sandtime.io was an excellent example of switching from one approach to another due to real needs. In the beginning, the whole project, as well as the development process, was a cascade. After three months, the software development process was changed to Scrum. Then, the whole development was shifted to follow Kanban rules and principles. This is what has been called in SSD an agile mindset. It is possible because SSD has highly educated and experienced personnel, certified in the traditional approach (e.g., IPMA level D, C, and B), as well as in the agile approach (e.g., Certified Scrum Masters).

Other rules or principles that helped build SSD culture are related to the daily routines and duties. One of the rules is related to the open-source world. SSD decided not to keep the ownership for itself but share the ownership with subcontractors. Therefore, all the projects and subprojects published in the open-source world have similar characteristics:

- Even though SSD is paying for the work, the ownership of the subcontractor is secured;
- Each person involved or committed to the work has to be mentioned as a contributor. For instance, the SSD is commonly a "financial", "business development", and "ideas, planning & feedback" contributor.

The same rules have been kept for all the blog post articles and other whitepapers created during the development of Sandtime.io. This kind of solution seems to be fair for both sides.

Another essential part of building a collaborative culture was publishing several features on GitHub. It was decided to not only use open-source solutions but also invest time and money in adding high-quality source code to the open-source community. This allowed for associating several not employed contributors to Sandtime.io and sharing with the world SSDs internal solutions for typical issues such as React swipeable lists or using Chatwoot with react websites.

It is important to mention that comments and reported issues by people that used shared solutions were considered, and most of them were added to the product backlog.

All attribution to external libraries and frameworks (most of them are open source) were listed on our landing page (~2200 external solutions were adopted) [86].

Another crucial part of building Sandtime.io in a collaborative culture was to keep the product safe and secure. Besides the fact that the product is obligated to specific laws (e.g., GPR, KYC), it was decided to keep it safe from internal and external sabotages. This goal was covered by:

- Not keeping the unnecessary data of the users by collecting the minimum data needed to log in or optimize Sandtime.io;
- Anonymizing the google analytics data by sending hash codes instead of real data, so even google knows nothing about Sandtime.io users;
- Disallowing administrative access to users' data by limiting it. At this moment, it is impossible to log in on behalf of the user. The only way to support users on this level is possible by granting time-limited rights for impersonation for the support team member.

All mentioned principles arrived from the SSD leader's experience and are continuously improved and rearranged to keep the project management and software development process sustainable. By sustainability, SSD understands the people, the profit, and the planet as the three bottom lines of building a healthy and innovative company.

5. Discussion

The conducted review of the literature and the conclusions resulting from the analysis of the cited case study allowed for the operationalization of activities supporting open innovations in relation to implementing OI at the organizational level. In the following discussion, an answer to the research question is given, and a theoretical model illustrating all the dimensions mentioned above is presented (Figure 2).

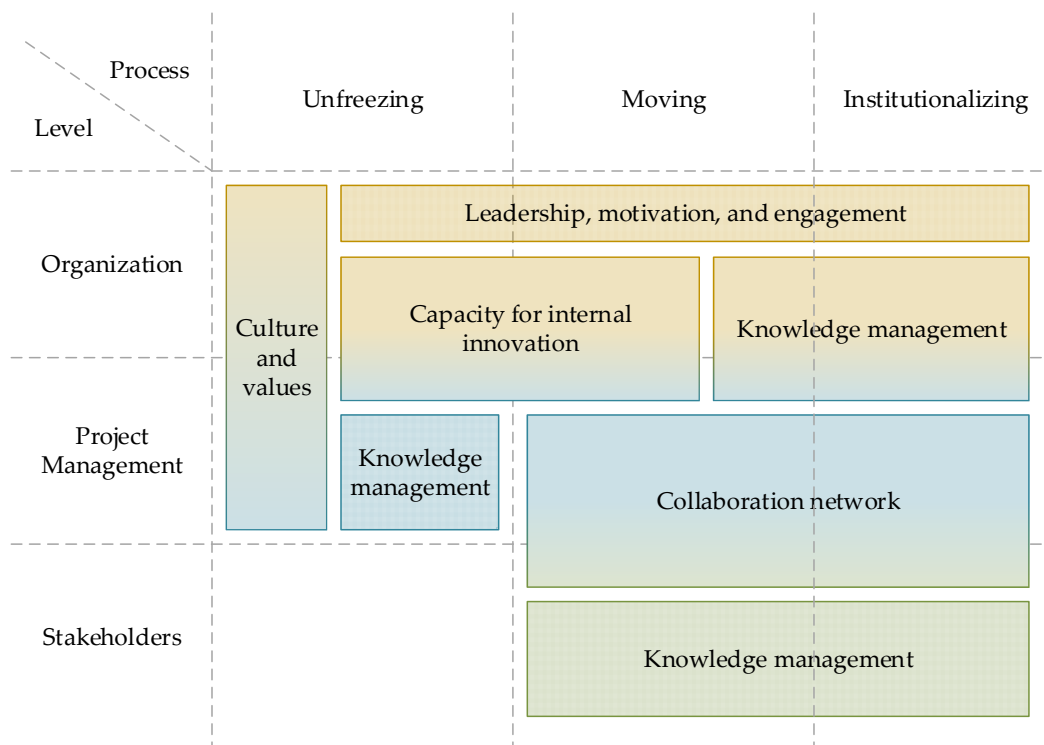


Figure 2. A theoretical model of implementing open innovations in software development micro-organizations.

5.1. Unfreezing Phase

According to the adopted model, the first actions that an organization must undertake in the unfreezing phase is included in the appropriate preparation of culture and values. As emphasized by the authors [87], organizations are social systems in which behaviors are embedded in a culture that includes common values, norms, habits, or goals. Programming organizations wishing to prepare their own culture and values for implementing OI properly must pay special attention to open communication, an agile management model, processes related to intellectual property, and mechanisms of motivating and engaging employees in innovative processes. An effective system of open communication increases the efficiency of employees and, at the same time, leads to an increase in their trust [88]. A positive effect is an increase in general motivation to work and a reduction in employees’ resistance to change. The agile approach, characteristic of the IT industry, assumes an uncomplicated work organization based on small self-organizing teams with a strong emphasis on cooperation, communication, and integration of team members [89].

Moreover, the agile approach is focused on flexibility, speed, and adaptability to changes while being a driving force for innovative processes [90]. Programming organizations implementing the OI model must also take care of the rules regarding the intellectual property of the developed software, especially when it concerns open-source software. In the analyzed case, the SSD organization adopted an open model of sharing the property with subcontractors while adequately rewarding them financially in accordance with the concluded contracts. Adopting such a model also increases the motivation and involvement of programmers in building the organization’s competitive advantage. Moreover, establish-

ing such a mechanism also allows the organization to introduce new employees in the first place to open-source projects, where it is possible to verify their skills and experience while developing the product using new ideas.

Another crucial area is leadership, motivation, and commitment at the organizational level. In the unfreezing phase, leadership focuses on the business viability of implementing OI models that generate a number of changes. In the example cited herein, the SSD organization implemented applications for customers that, in accordance with the contractual provisions, they could not be proud of while acquiring new customers. In connection with the above, the business rationale adopted by SSD for the OI model was to create an application that would be a product not only socially distributed but, above all, attract new customers, thus increasing its competitive advantage. The organization pointing to this justification must simultaneously link it with strategic goals. Moreover, as emphasized by Chiaroni et al. [41], building an appropriate vision supported by business legitimacy improves the process of communication with stakeholders and builds their engagement.

The ability to innovate internally at the organizational level is responsible for the actual planning of the OI model implementation. Changes leaders at this level should pay particular attention to is prioritizing the undertaken activities and projects [91], selecting an approach to project management [26], and analyzing competencies and technical possibilities related to R&D [55]. On the other hand, at the level of project management, this dimension focuses on the appropriate selection of a project team with a defined division of responsibilities and powers, which at the same time will support the decision-making process at the organizational level [47].

As Gray [92] emphasizes, the source of innovation is the skillful use of knowledge, which is a strategic resource of the organization. In the unfreezing phase, the organization basically does not generate new knowledge but only relies on its own experiences and determines the possible mechanisms of its absorption from the outside. As emphasized by the authors [47], knowledge in this area will usually reflect regulations in the form of rules, strategies, or procedures. At this stage, the programming organization must also ensure the collection of previous experience and knowledge from the projects implemented so far and define the mechanisms of their categorization.

5.2. Moving Phase

Moving leadership focuses on providing direction for those who are involved in the OI implementation process. The adopted strategic goals and visions are decomposed at this level into individual activities and projects. As noted by Zynga et al. [45], at this stage, it is also important to identify people with key roles as scouts and gatekeepers who will also support the transformation process in its beginning stage. Moreover, leadership is involved in selecting and applying appropriate management styles depending on the situation. Given the software development micro-organizations whose organizational structures are highly flattened, which are focused on small project teams, where the top management also plays the role of the immediate supervisor, determining behavior patterns, communication methods, or ways of monitoring and controlling the implementation of individual work becomes an essential factor in the success of maintaining employee involvement in the OI implementation process.

The ability to innovate internally at the organizational level in this phase of the OI implementation is responsible for determining the mechanisms of transferring the results of undertaken activities and projects to the business level. Moreover, these mechanisms should also ensure that the benefits obtained are properly used by the organization and its related business partners [41]. To that end, software development micro-organizations also need to take care of monitoring procedures. However, as noted by Zynga et al. [45], the procedure must be appropriate to the size and complexity of the activities undertaken to avoid overburdening with judgment. On the other hand, at the level of project management, relevant operations focus on the actual delivery of products and the results of implemented projects. The critical factor in this respect is the formal inter-project structure of periodic

meetings and project workshops, increasing the process integrity of the organization, and supporting open communication and knowledge transfer.

One of the basic determinants of open innovation is building a cooperation network to search for the organization's complementary assets [93]. In the moving phase, mainly the actions that micro-organizations should take are determined by project management, which provides tools not only for analyzing potential stakeholders but also for their involvement in the product delivery process. Moreover, for the developed OSS software to increase the organization's value, the needs and expectations of potential partners should be examined first. Otherwise, it may not be accepted in the market, thus generating only costs with no potential benefits to the organization. For an effective OI implementation process, it is equally important to build relationships and involve resources in the entire innovation process. This is because it is the foundation for productive cooperation and creating a whole network of relationships [94]. Organizations must also prepare mechanisms to create lasting and stable relations with the environment that will allow them to increase their competitiveness. The above activities should enable companies to acquire new customers, references, or new knowledge and technology.

Knowledge management in the moving phase will take place on all three levels. At the organizational level, there should be an internal exploration of the newly acquired knowledge resulting from the innovative activities undertaken at the project management level, simultaneously enabling the development of creative abilities for newly initiated activities and projects. The open innovation model emphasizes that organizations should not only obtain knowledge from the environment but also provide it [9]. At the stakeholder level, the knowledge management dimension will focus on identifying opportunities to share the accumulated knowledge and technology with the community. In the field of OSS, the scope of the solutions provided and the time in which they should be made available seem to be necessary. The above activities must also be consistent with the adopted business model corresponding to the strategic goals being pursued.

5.3. Institutionalising Phase

In the institutionalizing phase, the organization's leadership should focus on formalizing the resulting products, activities, and procedures while building trust in openness in the organization. Furthermore, this phase should also include setting new goals to maintain and develop the resulting solutions.

The main goal of this phase is to validate, consolidate, and standardize the improvements achieved in the previous phase while preventing a return to the previous state [48]. As Lopes et al. [95] pointed out, integrating knowledge management with the organization's business processes positively influences the protection of intellectual property and the effective use of assets. The foregoing is confirmed by García-Álvarez [96], who also stresses that business processes remain the main element linking implementation instruments with the formalization of knowledge management by realizing its potential benefits. Given the above and the conclusions from the analysis of the cited case study, software development micro-organizations at every organizational level must ensure the standardization of knowledge transfer both inside and outside the organization.

Throughout the cycle of implementing open innovation, the authors [47] emphasize that stakeholders will be identified, assessed, and monitored in terms of their involvement, attitude, and impact. The process of managing the cooperation network in this phase should not only provide the possibility of extending it but, above all, define predispositions to maintain effective cooperation. For example, the examined SSD organization implemented mechanisms to retain the best talent by building high-quality products or sharing the achieved value with subcontractors. Moreover, the organization should also provide opportunities for the leaders of their project teams to motivate themselves in terms of individual and team needs. Also, we cannot forget that any collaborative network needs a leader. The main task of software development micro-organizations under institutionalization is to assume this role while building trust and open communication.

6. Conclusions

Conclusions resulting from the conducted research and discussions have both a theoretical and practical contribution. The theoretical contribution focuses on two main aspects. Firstly, activities supporting the implementation of OI were defined and systematized, which are initiated depending on the implementation process and the organizational level at which a given process is carried out. Secondly, the inductive approach based on the case study allowed for developing a theoretical model of implementing open innovations in software development micro-organizations. On the other hand, the practical implications include recommendations for managers on implementing operationalized actions to effectively implement the open innovation model while building a competitive advantage. Moreover, the novelty introduced by the article is also an indication of the essential advantages of using the OI model by software development micro-organizations, thus building their competitive advantage.

Moreover, the conducted analysis provided evidence of the importance of linking the implementation of OI with the assumed strategic goals and the adopted business model. Given the above, further research is recommended to identify determinants that should be adopted when building a business model that takes into account innovative openness in software development micro-organizations. Another factor determining the success of OI implementation is adopting an agile approach, which, unlike traditional project management methods, allows for open communication. Effective implementation of changes, especially in the moving phase, is of significant importance. Still, in this area, research should be conducted, including analyzing the impact of the agile approach principles on the success factors of open innovations. The last key element that should be taken into account before implementing the OI model is the prevailing organizational culture. When analyzing the literature, the authors point to the lack of research in the field of motivation tools for increasing the efficiency of employees and allowing for the effective adoption of OI models.

The recommendations and the pro-positions of activities presented in the article (especially in the discussion section) are addressed not only to scientific researchers but primarily to managers looking for new innovative solutions to improve internal processes and increase organizational possibilities.

The authors also notice the disadvantages of the decisions made regarding the research process. Firstly, due to the specific research gap, an inductive approach based on a single-case study was adopted, which allowed for the operationalization of the obtained results while analyzing the literature and covered only a single organizational context. Secondly, the developed model was based mainly on theoretical aspects that require verification. Given the above, quantitative tests of the developed model should be conducted to enable its supplementation and extension.

The authors also see the main research limitation referring to the specific context resulting not only from the analysis of a single-case study, but above all, from the specific activity of a software company operating in an agile project management model. Such a limitation requires more thorough research, including validation or testing of the developed model in other entities and industry contexts.

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References

- Pellegrinelli, S.; Murray-Webster, R.; Turner, N. Facilitating organizational ambidexterity through the complementary use of projects and programs. *Int. J. Proj. Manag.* **2015**, *33*, 153–164. [\[CrossRef\]](#)
- Elali, W. The importance of strategic agility to business survival during corona crisis and beyond. *Int. J. Bus. Gov. Ethics* **2021**, *4*, 1–8. [\[CrossRef\]](#)
- Murphy, R.; Seriki, O. The impact of environmental turbulence on the strategic decision-making process in Irish quantity surveying (QS) professional service firms (PSFs). *Constr. Manag. Econ.* **2021**, *39*, 739–758. [\[CrossRef\]](#)
- Gyedu, S.; Tang, H.; Ntarmah, A.H.; Manu, E.K. The moderating effect of environmental turbulence on the relationship between innovation capability and business performance. *Int. J. Innov. Sci.* **2021**, *13*, 456–476. [\[CrossRef\]](#)
- AlMulhim, A.F. The role of internal and external sources of knowledge on frugal innovation: Moderating role of innovation capabilities. *Int. J. Innov. Sci.* **2021**, *13*, 341–363. [\[CrossRef\]](#)
- Hervas-Oliver, J.L.; Sempere-Ripoll, F.; Boronat-Moll, C. Technological innovation typologies and open innovation in SMEs: Beyond internal and external sources of knowledge. *Technol. Forecast. Soc. Chang.* **2021**, *162*, 120338. [\[CrossRef\]](#)
- Naramski, M.; Szromek, A.R.; Herman, K.; Polok, G. Assessment of the Activities of European Cultural Heritage Tourism Sites during the COVID-19 Pandemic. *J. Open Innov. Technol. Mark. Complex.* **2022**, *8*, 55. [\[CrossRef\]](#)
- Li, H.; Hu, Q.; Zhao, G.; Li, B. The co-evolution of knowledge management and business model transformation in the post-COVID-19 era: Insights based on Chinese e-commerce companies. *J. Knowl. Manag.* **2021**, *26*, 1113–1123. [\[CrossRef\]](#)
- Turoń, K. Open innovation business model as an opportunity to enhance the development of sustainable shared mobility industry. *J. Open Innov. Technol. Mark. Complex.* **2022**, *8*, 37. [\[CrossRef\]](#)
- Shaikh, I.; Randhawa, K. Managing the risks and motivations of technology managers in open innovation: Bringing stakeholder-centric corporate governance into focus. *Technovation* **2022**, *114*, 102437. [\[CrossRef\]](#)
- Martinsuo, M. Strategic value at the front end of a radical innovation program. *Proj. Manag. J.* **2019**, *50*, 431–446. [\[CrossRef\]](#)
- Martinez, M.G. Co-creation of value by open innovation: Unlocking new sources of competitive advantage. *Agribusiness* **2014**, *30*, 132–147. [\[CrossRef\]](#)
- Paternoster, N.; Giardino, C.; Unterkalmsteiner, M.; Gorschek, T.; Abrahamsson, P. Software development in startup companies: A systematic mapping study. *Inf. Softw. Technol.* **2014**, *56*, 1200–1218. [\[CrossRef\]](#)
- Cano-Kollmann, M.; Awate, S.; Hannigan, T.J.; Mudambi, R. Burying the hatchet for catch-up: Open innovation among industry laggards in the automotive industry. *Calif. Manag. Rev.* **2018**, *60*, 17–42. [\[CrossRef\]](#)
- Naramski, M. The Application of ICT and Smart Technologies in Polish Museums—Towards Smart Tourism. *Sustainability* **2020**, *12*, 9287. [\[CrossRef\]](#)
- Abubakar, M.N. Innovation Co-operation Impact on Operations of Small, Medium and Large (SML) Firms: A Malaysia Perspective. *Ind.-Pac. J. Account. Financ.* **2018**, *2*, 4–15. [\[CrossRef\]](#)
- Saebi, T.; Foss, N.J. Business models for open innovation: Matching heterogeneous open innovation strategies with business model dimensions. *Eur. Manag. J.* **2015**, *33*, 201–213. [\[CrossRef\]](#)
- Zhou, X.; Song, M.; Cui, L. Driving force for China's economic development under Industry 4.0 and circular economy: Technological innovation or structural change? *J. Clean. Prod.* **2020**, *271*, 122680. [\[CrossRef\]](#)
- Singh, S.H.; Bhowmick, B.; Eesley, D.; Sindhav, B. Grassroots innovation and entrepreneurial success: Is entrepreneurial orientation a missing link? *Technol. Forecast. Soc. Chang.* **2021**, *164*, 119582. [\[CrossRef\]](#)
- Cao, Y.; Chen, Y.; Zhang, Y. Political uncertainty, innovation-driven strategy, and corporate R&D. *Res. Int. Bus. Financ.* **2022**, *60*, 101612.
- García-González, A.; Ramírez-Montoya, M.S. Systematic mapping of scientific production on open innovation (2015–2018): Opportunities for sustainable training environments. *Sustainability* **2019**, *11*, 1781. [\[CrossRef\]](#)
- Hong, J.F.; Zhao, X.; Stanley Snell, R. Collaborative-based HRM practices and open innovation: A conceptual review. *Int. J. Hum. Resour. Manag.* **2019**, *30*, 31–62. [\[CrossRef\]](#)
- Bigliardi, B.; Ferraro, G.; Filippelli, S.; Galati, F. The past, present and future of open innovation. *Eur. J. Innov. Manag.* **2021**, *24*, 1130–1161. [\[CrossRef\]](#)
- Chesbrough, H. The Era of Open Innovation. *MIT Sloan Manag. Rev.* **2003**, *44*, 35–41.
- Rauter, R.; Globocnik, D.; Perl-Vorbach, E.; Baumgartner, R.J. Open innovation and its effects on economic and sustainability innovation performance. *J. Innov. Knowl.* **2019**, *4*, 226–233. [\[CrossRef\]](#)
- Ferraris, A.; Santoro, G.; Papa, A. The cities of the future: Hybrid alliances for open innovation projects. *Futures* **2018**, *103*, 51–60. [\[CrossRef\]](#)
- Munir, H.; Linåker, J.; Wnuk, K.; Runeson, P.; Regnell, B. Open innovation using open source tools: A case study at Sony Mobile. *Empir. Softw. Eng.* **2018**, *23*, 186–223. [\[CrossRef\]](#)
- Inauen, M.; Schenker-Wicki, A. The impact of outside-in open innovation on innovation performance. *Eur. J. Innov. Manag.* **2011**, *14*, 496–520. [\[CrossRef\]](#)

29. Munir, H.; Wnuk, K.; Runeson, P. Open innovation in software engineering: A systematic mapping study. *Empir. Softw. Eng.* **2016**, *21*, 684–723. [CrossRef]
30. Linåker, J.; Munir, H.; Runeson, P.; Regnell, B.; Schrewelius, C. A Survey on the Perception of Innovation in a Large Product-Focused Software Organization. In *Software Business*; Fernandes, J., Machado, R., Wnuk, K., Eds.; Lecture Notes in Business Information Processing; Springer: Cham, Switzerland, 2015; Volume 210. [CrossRef]
31. Crema, M.; Verbano, C.; Venturini, K. Linking strategy with open innovation and performance in SMEs. *Meas. Bus. Excell.* **2014**, *18*, 14–27. [CrossRef]
32. Hameed, W.U.; Basheer, M.F.; Iqbal, J.; Anwar, A.; Ahmad, H.K. Determinants of Firm's open innovation performance and the role of R & D department: An empirical evidence from Malaysian SME's. *J. Glob. Entrep. Res.* **2018**, *8*, 29.
33. Rangus, K.; Drnovšek, M. Open innovation in Slovenia: A comparative analysis of different firm sizes. *Econ. Bus. Rev.* **2013**, *15*, 175–196. [CrossRef]
34. Ehls, D. Open source project collapse—sources and patterns of failure. In Proceedings of the 50th Hawaii International Conference on System Sciences, Waikoloa, HI, USA, 4–7 January 2017; pp. 5327–5336.
35. Kohler, T.; Nickel, M. Crowdsourcing business models that last. *J. Bus. Strategy* **2017**, *38*, 25–32. [CrossRef]
36. Bogers, M.; Chesbrough, H.; Moedas, C. Open innovation: Research, practices, and policies. *Calif. Manag. Rev.* **2018**, *60*, 5–16.
37. Ovuakporie, O.D.; Pillai, K.G.; Wang, C.; Wei, Y. Differential moderating effects of strategic and operational reconfiguration on the relationship between open innovation practices and innovation performance. *Res. Policy* **2021**, *50*, 104146. [CrossRef]
38. Lakhani, K.R.; von Hippel, E. How open source software works: “free” user-to-user assistance. *Res. Policy* **2003**, *32*, 923–943. [CrossRef]
39. Wnuk, K.; Pfahl, D.; Callele, D.; Karlsson, E.-A. How can open source software development help requirements management gain the potential of open innovation: An exploratory study. In Proceedings of the ACM-IEEE International Symposium on Empirical Software Engineering and Measurement, ESEM'12, ACM, New York, NY, USA, 20–21 September 2012; pp. 271–280.
40. Rolandsson, B.; Bergquist, M.; Ljungberg, J. Open source in the firm Opening up professional practices of software development. *Res. Policy* **2011**, *40*, 576–587. [CrossRef]
41. Chiaroni, D.; Chiesa, V.; Frattini, F. The Open Innovation Journey: How firms dynamically implement the emerging innovation management paradigm. *Technovation* **2011**, *31*, 34–43. [CrossRef]
42. Abhari, K.; McGuckin, S. Limiting factors of open innovation organizations: A case of social product development and research agenda. *Technovation* **2022**, 102526, in press. [CrossRef]
43. Lewin, K. Frontiers in group dynamics: II. Channels of group life; social planning and action research. *Hum. Relat.* **1947**, *1*, 143–153. [CrossRef]
44. Kotter, J.P. *Leading Change*; Harvard Business Press: Boston, MA, USA, 2012.
45. Zynga, A.; Diener, K.; Ihl, C.; Lüttgens, D.; Piller, F.; Scherb, B. Making Open Innovation Stick: A Study of Open Innovation Implementation in 756 Global Organizations: A large study of international companies shows that distinct routines and organizational structures differentiate organizations that succeed with open innovation. *Res. Technol. Manag.* **2018**, *61*, 16–25.
46. Armenakis, A.A.; Bedeian, A.G. Organizational change: A review of theory and research in the 1990s. *J. Manag.* **1999**, *25*, 293–315. [CrossRef]
47. Trzeciak, M.; Kopec, T.P.; Kwilinski, A. Constructs of Project Programme Management Supporting Open Innovation at the Strategic Level of the Organisation. *J. Open Innov. Technol. Mark. Complex.* **2022**, *8*, 58. [CrossRef]
48. Roberts, D.L.; Palmer, R.; Hughes, M. Innovating the product innovation process to enable co-creation. *R&D Manag.* **2022**, *52*, 484–497.
49. Cameron, E.; Green, M. *Making Sense of Change Management: A Complete Guide to the Models, Tools and Techniques of Organizational Change*; Kogan Page Publishers: London, UK, 2019.
50. Jansen, S.; Brinkemper, S.; Souer, J.; Luinenburg, L. Shades of gray Opening up a software producing organization with the open software enterprise model. *J. Syst. Softw.* **2012**, *85*, 1495–1510. [CrossRef]
51. Linåker, J.; Rempel, P.; Regnell, B.; Mäder, P. How Firms Adapt and Interact in Open Source Ecosystems: Analyzing Stakeholder Influence and Collaboration Patterns. In *Requirements Engineering: Foundation for Software Quality*; Daneva, M., Pastor, O., Eds.; Lecture Notes in Computer Science; Springer: Cham, Switzerland, 2016; p. 9619. [CrossRef]
52. Arai, Y. Intellectual property right protection in the software market. *Econ. Innov. New Technol.* **2018**, *27*, 1–13. [CrossRef]
53. Daniel, S.; Maruping, L.; Cataldo, M.; Herbsleb, J. When cultures clash: Participation in open source communities and its implications for organizational commitment. In Proceedings of the International Conference on Information Systems, ICIS 2011, Shanghai, China, 4–7 December 2011; Available online: <https://aisel.aisnet.org/icis2011/proceedings/projmanagement/7> (accessed on 4 July 2022).
54. Zhou, M.; Mockus, A.; Ma, X.; Zhang, L.; Mei, H. Inflow and retention in oss communities with commercial involvement: A case study of three hybrid projects. *Trans. Softw. Eng. Methodol.* **2016**, *25*, 1–29. [CrossRef]
55. de Oliveira, L.S.; Echeveste, M.E.; Cortimiglia, M.N. Critical success factors for open innovation implementation. *J. Organ. Chang. Manag.* **2018**, *31*, 1283–1294. [CrossRef]
56. von Briel, F.; Recker, J. Lessons from a failed implementation of an online open innovation community in an innovative organization. *MIS Q. Exec.* **2017**, *16*, 35–46.

57. Pichlak, M.; Szromek, A.R. Eco-Innovation, Sustainability and Business Model Innovation by Open Innovation Dynamics. *J. Open Innov. Technol. Mark. Complex.* **2021**, *7*, 149. [CrossRef]
58. Urbinati, A.; Chiaroni, D.; Chiesa, V.; Frattini, F. The role of digital technologies in open innovation processes: An exploratory multiple case study analysis. *R&D Manag.* **2020**, *50*, 136–160.
59. Abulrub, A.-H.; Lee, J. Open innovation management: Challenges and prospects. *Proc. Soc. Behav. Sci.* **2012**, *41*, 130–138. [CrossRef]
60. McGahan, A.M.; Bogers, M.; Chesbrough, H.; Holgersson, M. Tackling Societal Challenges with Open Innovation. *Calif. Manag. Rev.* **2021**, *63*, 49–61. [CrossRef]
61. Bogers, M.; Chesbrough, H.; Heaton, S.; Teece, D.J. Strategic Management of Open Innovation: A Dynamic Capabilities Perspective. *Calif. Manag. Rev.* **2019**, *62*, 77–94. [CrossRef]
62. Schoemaker, P.J.H.; Heaton, S.; Teece, D. Innovation, Dynamic Capabilities, and Leadership. *Calif. Manag. Rev.* **2018**, *61*, 15–42. [CrossRef]
63. Enkel, E.; Gassmann, O.; Chesbrough, H. Open R&D and open innovation: Exploring the phenomenon. *R&D Manag.* **2009**, *39*, 311–316.
64. Bagherzadeh, M.; Markovic, S.; Bogers, M. Managing open innovation: A project-level perspective. *IEEE Trans. Eng. Manag.* **2019**, *68*, 301–316. [CrossRef]
65. Xia, H.; Weng, J. Effectiveness of industry-university-research cooperation in China: Impact of innovation input and open innovation environment. *Int. J. Innov. Sci.* **2021**, *14*, 62–78. [CrossRef]
66. Villani, E.; Rasmussen, E.; Grimaldi, R. How intermediary organizations facilitate university–industry technology transfer: A proximity approach. *Technol. Forecast. Soc. Chang.* **2017**, *114*, 86–102. [CrossRef]
67. Yeşil, S.; Koska, A.; Büyükbese, T. Knowledge sharing process, innovation capability and innovation performance: An empirical study. *Proc. Soc. Behav. Sci.* **2013**, *75*, 217–225. [CrossRef]
68. Scuotto, V.; Del Giudice, M.; Bresciani, S.; Meissner, D. Knowledge-driven preferences in informal inbound open innovation modes. An explorative view on small to medium enterprises. *J. Knowl. Manag.* **2017**, *21*, 640–655. [CrossRef]
69. Cheah, S.L.Y.; Ho, Y.P. Effective industrial policy implementation for open innovation: The role of government resources and capabilities. *Technol. Forecast. Soc. Chang.* **2020**, *151*, 119845. [CrossRef]
70. Lazzarotti, V.; Manzini, R.; Pellegrini, L. Is your open innovation successful? The mediating role of a firm’s organizational and social context. *Int. J. Hum. Resour. Manag.* **2015**, *26*, 2453–2485. [CrossRef]
71. Du Chatenier, E.; Verstegen, J.A.; Biemans, H.J.; Mulder, M.; Omta, O. The challenges of collaborative knowledge creation in open innovation teams. *Hum. Resour. Dev. Rev.* **2009**, *8*, 350–381. [CrossRef]
72. Naqshbandi, M.M.; Tabche, I.; Choudhary, N. Managing open innovation: The roles of empowering leadership and employee involvement climate. *Manag. Decis.* **2019**, *57*, 703–723. [CrossRef]
73. Podmetina, D.; Soderquist, K.E.; Petraite, M.; Teplov, R. Developing a competency model for open innovation: From the individual to the organisational level. *Manag. Decis.* **2018**, *56*, 1306–1335. [CrossRef]
74. Ebneyamini, S.; Sadeghi Moghadam, M.R. Toward developing a framework for conducting case study research. *Int. J. Qual. Methods* **2018**, *17*, 1609406918817954. [CrossRef]
75. Abbate, T.; Codini, A.P.; Aquilani, B. Knowledge co-creation in open innovation digital platforms: Processes, tools and services. *J. Bus. Ind. Mark.* **2019**, *34*, 1434–1447. [CrossRef]
76. Wang, Y.C.; Phillips, F.; Yang, C. Bridging innovation and commercialization to create value: An open innovation study. *J. Bus. Res.* **2021**, *123*, 255–266. [CrossRef]
77. Yin, R.K. *Case Study Research: Design and Methods*; SAGE Publication: Thousand Oaks, CA, USA, 2014; Volume 5.
78. Robinson, O.C. Sampling in interview-based qualitative research: A theoretical and practical guide. *Qual. Res. Psychol.* **2014**, *11*, 25–41. [CrossRef]
79. Toma, A.; Secundo, G.; Passiante, G. Open innovation and intellectual property strategies: Empirical evidence from a bio-pharmaceutical case study. *Bus. Process Manag. J.* **2018**, *24*, 501–516. [CrossRef]
80. Gurca, A.; Bagherzadeh, M.; Markovic, S.; Koporcic, N. Managing the challenges of business-to-business open innovation in complex projects: A multi-stage process model. *Ind. Mark. Manag.* **2021**, *94*, 202–215. [CrossRef]
81. Sandstream Development Sp. z o. o. Available online: <https://sanddev.com/about-us> (accessed on 20 August 2022).
82. Rigby, D.K.; Sutherland, J.; Noble, A. Agile at scale. *Harv. Bus. Rev.* **2018**, *96*, 88–96.
83. Lindvall, M.; Muthig, D.; Dagnino, A.; Wallin, C.; Stupperich, M.; Kiefer, D.; May, J.; Kahkonen, T. Agile software development in large organizations. *Computer* **2004**, *37*, 26–34. [CrossRef]
84. Tam, C.; da Costa Moura, E.J.; Oliveira, T.; Varajão, J. The factors influencing the success of on-going agile software development projects. *Int. J. Proj. Manag.* **2020**, *38*, 165–176. [CrossRef]
85. Sandtime.io—Knowledge Base. Available online: <https://help.sandtime.io/en/sandtime-io-time-tracker-knowledgebase/> (accessed on 20 August 2022).
86. Sandtime.io—Attribution. Available online: <https://sandtime.io/attribution> (accessed on 20 August 2022).
87. Yun, J.J.; Zhao, X.; Jung, K.; Yigitcanlar, T. The Culture for Open Innovation Dynamics. *Sustainability* **2020**, *12*, 5076. [CrossRef]
88. Sonmez Cakir, F.; Adiguzel, Z. Analysis of leader effectiveness in organization and knowledge sharing behavior on employees and organization. *Sage Open* **2020**, *10*, 2158244020914634. [CrossRef]

89. Malik, M.; Sarwar, S.; Orr, S. Agile practices and performance: Examining the role of psychological empowerment. *Int. J. Proj. Manag.* **2021**, *39*, 10–20. [[CrossRef](#)]
90. Rasnacis, A.; Berzisa, S. Method for adaptation and implementation of agile project management methodology. *Proc. Comput. Sci.* **2017**, *104*, 43–50. [[CrossRef](#)]
91. Caetano, M.; Amaral, D.C. Roadmapping for technology push and partnership: A contribution for open innovation environments. *Technovation* **2011**, *31*, 320–335. [[CrossRef](#)]
92. Gray, C. Absorptive capacity, knowledge management and innovation in entrepreneurial small firms. *Int. J. Entrep. Behav. Res.* **2006**, *12*, 345–360. [[CrossRef](#)]
93. Mention, A.L. Co-operation and co-opetition as open innovation practices in the service sector: Which influence on innovation novelty? *Technovation* **2011**, *31*, 44–53. [[CrossRef](#)]
94. Strode, D.; Dingsøyr, T.; Lindsjorn, Y. A teamwork effectiveness model for agile software development. *Empir. Softw. Eng.* **2022**, *27*, 56. [[CrossRef](#)]
95. Lopes, C.M.; Scavarda, A.; Hofmeister, L.F.; Thomé, A.M.T.; Vaccaro, G.L.R. An analysis of the interplay between organizational sustainability, knowledge management, and open innovation. *J. Clean. Prod.* **2017**, *142*, 476–488. [[CrossRef](#)]
96. García-Álvarez, M.T. Analysis of the effects of ICTs in knowledge management and innovation: The case of Zara Group. *Comput. Hum. Behav.* **2015**, *51*, 994–1002. [[CrossRef](#)]