CONNIS: MULTILATERAL PLATFORM FOR INTEGRATION OF COMPANIES AND SCIENCE AND TECHNOLOGY INSTITUTIONS

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Abstract: The project aimed to develop a prototype of a multilateral platform called CONNIS, designed to connect companies facing challenges and issues for collaboration and problem-solving into a sustainable business. The platform is also integrated with SENAI CIMATEC, offering R&D services and consulting. The Theoprax methodology was employed in the project development, emphasizing the integration of theory and practice. The outcome was a functional MVP of the platform, featuring functionalities such as proposal registration, expression of interest, counterproposal, and negotiation. The platform aims to foster innovation, facilitate business negotiations, and attract connections to SENAI CIMATEC.

Keywords: multilateral platform, CONNIS, SENAI CIMATEC, Theoprax, innovation

CONNIS: PLATAFORMA MULTILATERAL PARA INTEGRAÇÃO DE EMPRESAS E INSTITUIÇÕES DE CIÊNCIA E TECNOLOGIA

Resumo: O projeto teve como objetivo desenvolver um protótipo de uma plataforma multilateral chamada CONNIS, projetada para conectar empresas que enfrentam desafios e problemas para colaboração e solução de problemas em um negócio sustentável. A plataforma também está integrada ao SENAI CIMATEC, oferecendo serviços de P&D e consultoria. A metodologia Theoprax foi utilizada no desenvolvimento do projeto, enfatizando a integração entre teoria e prática. O resultado foi um MVP funcional da plataforma, com funcionalidades como registro de propostas, manifestação de interesse, contraproposta e negociação. A plataforma visa promover a inovação, facilitar negociações empresariais e atrair conexões para o SENAI CIMATEC.

Palavras-chave: plataforma multilateral, CONNIS, SENAI CIMATEC, Theoprax, inovação

1. INTRODUCTION

Higher education institutions are fundamental in the pursuit of knowledge, consisting of a triad: research, education, and extension [1]. Besides fostering the education of qualified professionals, these institutions play a proactive role in social development. However, research and development require the interaction of various stakeholders, which can often present challenges in managing those involved.

It is essential for businesses and educational institutions to collaborate on research and development projects to strengthen cooperation and drive innovation [2]. Managing an innovation ecosystem is a complex task, requiring coordination skills and alignment of diverse interests. In this context, the support of management tools assists in this process, providing greater efficiency and facilitating the integration of different actors in the innovation process. This network, formed by companies, research institutions, and, in some cases, public organizations, lacks an orderly management method.

A multilateral platform is a type of platform that facilitates the connection and interaction among multiple participants, enabling the exchange of information, services, products, or resources between them [3]. It acts as an intermediary, providing an environment where different agents can meet and collaborate.

Multilateral Platforms have played an important role in establishing integrated networks, allowing users to find challenges and solutions to various industry problems [4]. Such ecosystems enable an open atmosphere for information exchange among different agents throughout a production chain. This leads to the creation of a "network effect" [5], where the leverage of synergies is maximized, allowing for the discovery of solutions that demonstrate sustainable operations and make their production chains more ecologically friendly.

On the other hand, a large number of companies have been considering innovation routes to engage in research and development, mainly seeking to address internal demands, problems in their production chains, or aiming to enhance their sustainability performance. Environmental, Social, and Governance (ESG) issues are increasingly influencing companies' decisions regarding which practices to adopt and what returns are expected by society and their stakeholders [6].

The objective of this work is to develop a multilateral platform that aims to establish a connection between companies with demands and companies with the capacity to address them, integrated with the SENAI CIMATEC Institute of Science and Technology, which offers Research & Development services and consultancy, thereby enhancing the viability of sustainable businesses.

2. METHODOLOGY

The present work was developed using the Theoprax methodology. This methodology is based on the idea that theory and practice should be inseparable and complementary. It seeks to overcome the common dichotomy between these two

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dimensions, promoting a systemic and integrated approach. The methodology emphasizes the importance of acquiring theoretical knowledge, but also highlights that the most significant learning occurs when this knowledge is applied in practice [7].

In this context, the project was initiated through customer prospecting to develop the stages of problem identification, goal definition, solution planning, development, testing, and approval.

During the requirements gathering stage, the possibility of enhancing connections between companies that sometimes have similar internal demands and can support each other in problem-solving was identified. Additionally, the role of Science and Technology Institutions in enabling company projects through technical knowledge, consultancy, and investments was identified.

Subsequently, the solution of developing the CONNIS platform was reached. As a multilateral platform, companies can register on the CONNIS platform to submit proposals, which are identified problems, and view proposals from other companies. The role of Science and Technology Institutions (STIs) is to enable company projects through technical knowledge, consultancy, and investments. This interaction flow between the parties can be visualized in Figure 1.

In the flow below, Company 1, as the service requester, identifies a problem that cannot be solved internally or seeks more efficient or cost-effective external assistance to solve it. Upon accessing the platform to search for possible solutions, it finds a proposal registered by another company that delivers exactly what it needs. An offer is then made for this proposal. Company 2, as the service provider, receives this offer, accepts it, and both companies are directed to conduct negotiations. The STI is notified that a negotiation is taking place and receives some information to assess whether it can assist these companies with its provided services.

Figure 01: Interaction flowchart of the stakeholders. Source: Own Work
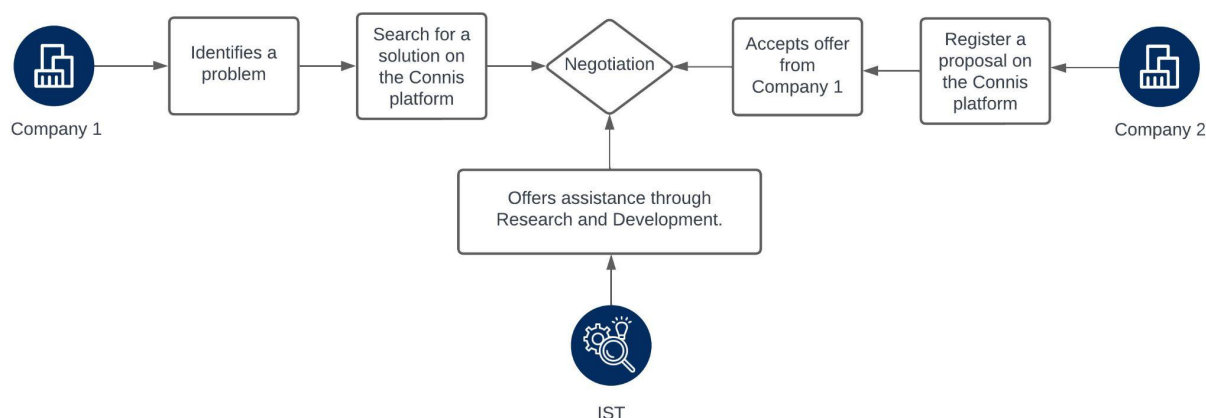
It is worth mentioning that to guide users in registering their demands and projects on the Connis platform, the Technology Readiness Level (TRL) model was adopted. TRL is a method created by NASA (National Aeronautics and Space Administration) in the 1970s to assess the technical maturity of a particular technology, which has been widely used in the research, development, and innovation ecosystem [8].

In 2015, the Brazilian Association of Technical Standards (BATS) nationalized the content, creating NBR ISO 16290:2015, which defines reference values for TRL (ranging from 0 to 9), allowing the classification of research, development, and implementation stages [9]. This enables consistent data to understand the evolution of technologies in the project.

After project planning and the construction of the work plan, the development of the platform began, which utilized different technologies, as described below.

The proposed project included the development of a front-end, back-end, and artificial intelligence (AI) functionalities. For the front-end, the Next.js framework was used to build modern and scalable user interfaces. Built on the React.js library, it offers features such as server-side rendering (SSR) and client-side rendering (CSR), a simplified routing system, and support for static and on-demand pre-rendering. The web application was hosted on the Vercel platform, which is well-suited for hosting applications with Next.js.

For the back-end, the .NET platform was mainly used, with the C# programming language, utilizing the ASP.NET and Entity Framework libraries for managing HTTP requests and database connection, respectively. A portion of the flow was implemented in Python using FastAPI.

The project was hosted in the Microsoft Azure cloud platform, which provides a wide range of services and tools for developing, implementing, and managing new applications and services.

Regarding the AI resources of the project, the ChatGPT API [10] was used, which is an application programming interface provided by OpenAI, allowing the integration of the ChatGPT language model with Connis platform functionalities.

The PostgreSQL database was chosen to store data from the main system. It is an open-source, free, and widely used relational database management system (RDBMS). Additionally, the ArangoDB database system [11] was used to store data in graph structure format.

User documents and images are stored in Azure Blob Storage, a cloud storage service offered by Microsoft Azure. For storing unstructured data, the Azure Storage Accounts service was chosen, allowing data persistence in various ways, such as tables, queues, and files.

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3. RESULTS AND DISCUSSION

As a result, a minimum viable product (MVP) of a multilateral platform called CONNIS was developed, with companies and Science and Technology Institutions (STIs) as its users. In this scenario, the participating STI was SENAI CIMATEC.

Among the functionalities present in the platform, companies can register proposals that are made available in a public catalog of proposals. To do this, the company needs to indicate the category of the proposal, which includes: waste, disruptive innovation, incremental innovation, and others, as presented in Figure 2.

Figure 02: Proposal Category Screen - Registration Step. Source: Own Work

In addition, the user is requested to choose the type of proposal that best fits their demand, which can be a proposal for Purchase/Sale, Donation, Exchange, or Research & Development (R&D). After filling out the proposal description, an AI algorithm will analyze the information provided by the user to support them in filling out the next step of the form, which presents keywords for the proposal. These keywords help identify potential solutions or connections for the registered proposal.

The last step of the proposal registration requests the user to provide the current maturity level of the proposal and the desired maturity level to be achieved, as shown at figure 3. As previously mentioned, the maturity level of the proposal is defined using the Technology Readiness Level framework.

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Figure 03: Technology Readiness Levels (TRL) Screen, Registration Step. Source: Own Work

Upon completing the registration, an algorithm is executed to search the graph of proposals stored in ArangoDB for previously registered proposals that may have similarity with the content just submitted. These proposals are then presented to the user for evaluation, allowing them to assess if any of them meet their requirements.

From the proposal catalog, service provider companies can express interest or make a counterproposal to the company that submitted the proposal, initiating a formal negotiation process facilitated by the Connis platform. Companies can accept or decline offers and conclude negotiations. The platform provides a chat feature and notifications about proposal activities.

As a multilateral platform, companies can register on the CONNIS platform to include proposals, which are identified problems, and view proposals from other companies. The role of Science and Technology Institutions (STIs) is to enable company projects through technical knowledge, consultancy, and investments. For the deliverable considered in this documentation, the Minimum Viable Product (MVP) of the project, the participating STI is SENAI CIMATEC.

The MVP was presented to the client, who was responsible for the project's conception and requirement direction, and feedback was collected based on his perception: "It is a challenge we face in the materials area to re-incorporate waste into production processes. We need a means to connect people, companies, and institutions that can add value to different challenges. I am immensely satisfied with the work delivered by the team, which presented a solution with a high degree of process automation and can assist in sustainability issues. The product can be rethought on how it can be implemented, but for a first version, I am very pleased, it exceeded expectations."

The CONNIS platform positions itself as a Business-to-Business (B2B) tool since it facilitates the connection between problems and solutions of different companies. The platform is expected to promote innovation and facilitate negotiations between companies. Additionally, it can enhance project prospecting for SENAI CIMATEC, and its focus on environmentally and socially sustainable solutions highlights its potential as a "sustainable business." The main benefits expected include fostering innovation, enhancing negotiations between companies, attracting new connections to SENAI CIMATEC, and facilitating the institution's negotiation management.

4. CONCLUSION

In the global market, multilateral platforms like Amazon, Alibaba, Airbnb, Uber, eBay, LinkedIn, and Facebook are well-known for their large user base and high level of activity. These platforms have played a significant role in the digital economy, connecting millions of people, businesses, and resources in their respective areas of operation.

Given the relevance that multilateral platforms have achieved in the global market, it is evident that Connis has great potential to reach multiple user profiles, companies, and ICTs looking to expand their connections. There is a clear possibility for Connis to become a unique and integrated platform, working in collaboration with funding agencies to enable complex solutions based on the challenges identified by companies in Brazil and worldwide.

The CONNIS platform is user-friendly and allows users to create filters to identify proposals of interest and optimize communication and understanding of demands between the parties involved in negotiations. During the project's development, new functionalities were also identified that were not included in the scope of the implemented MVP but could add value for users, such as an internal video call module and document sharing via chat.

As the next step, the need for validation of the proposed business model by the tool is recognized. To achieve this, the authors of this article intend to deploy the Connis platform in a production environment, to be used by an initial group of users, enabling the monitoring of functionalities and collection of feedback. This way, the effectiveness of the tool in addressing the identified opportunity can be measured.

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