E-roadmap to Support the Digital Transformation: Study, Design and Development of a Tool to Accelerate Digitalization in Lean Companies

Juliana Basulo Ribeiro
Department of Economics, Management, Industrial Engineering and Tourism (DEGEIT)
Universityof Aveiro, 3010-193, Aveiro, Portugal
basulojuliana@ua.pt

Marlene Amorim
Research Unit on Governance, Competitiveness and Public Policies (GOVCOPP) Department of Economics, Management, Industrial Engineering and Tourism (DEGEIT)
Universityof Aveiro, 3010-193, Aveiro, Portugal
mamorim@ua.pt

Leonor Teixeira
Institute of Electronics and Informatics Engineering of Aveiro (IEETA), Governance, Competitiveness and Public Policies (GOVCOPP), Department of Economics, Management, Industrial Engineering and Tourism (DEGEIT)
Universityof Aveiro, 3010-193, Aveiro Portugal
lteixeira@ua.pt

Abstract

Digitalization is increasingly imperative for companies that want to achieve a competitive advantage, which represents the transformation of traditional processes into digital processes by incorporating Industry 4.0 technologies. It is also known that to move towards this digital transformation it is necessary that the company already presents a good level of maturity in terms of lean philosophy, so the latter can be seen almost as a prerequisite. For a company to be successful in this digital transformation journey, it must develop a roadmap for digitalization, which guides it until it reaches the final goal, and there are already some guidelines to develop them. Therefore, by analyzing the literature it is possible to notice that there are not many technological tools that support this roadmap yet. This work contributes to filling the gap in the literature by describing a tool developed through the Microsoft Power Platform software that supports the roadmap for digital transformation in the collection and selection of processes, to develop an action plan aligned with the company's long-term strategy. This tool was then tested by the potential users, to validate the model, know the level of receptivity of the application by users, and understand the usefulness of the tool.

Keywords
Industry 4.0, Lean, Digital Transformation, BPMN2.0 and Roadmap

1. Introduction

Nowadays, it is already known that “The adoption of Industry 4.0 is no longer a choice.” (Butt 2020). Industry 4.0 (I4.0) is linked to the adoption of cyber-physical systems, which represent the connection between the physical and the digital world (Salvadorinho and Teixeira, 2021; Tambare et al. 2022). The fourth industrial revolution raised this concept of I4.0 and brought along several technological advances, which caused the need for some processes to become digital, through the incorporation of emerging technologies (Antonucci et al. 2021; Mahraz et al. 2019; Vigren et al. 2022). In this way, digitalization can be seen as the process of upgrading the traditional industry to digital, revolutionizing the ways in which organizations operate by seeking greater process efficiency through the use of I4.0

technologies (Issa et al. 2018). Moreover, the fact of the emergence of Covid-19, and the consequent pandemic context in which we live reinforced the need for digital transformation in companies (Reuschl et al. 2022).

In fact, businesses are increasingly facing the challenge of digital transformation to gain competitive advantages, so, it is crucial to develop a roadmap to succeed in this transformation (Ghobakhloo 2018). According to De Carollis (2018), to develop this roadmap for digital transformation it is important to follow two steps: *step 1* – to analyze the digital maturity level of the company, assessing the current state of the processes; *step 2* – to identify the strengths and weaknesses in terms of digital maturity of the company's processes to conclude about which are the potential processes the company benefits with the concentration of improvements efforts. From this analysis of strengths and weaknesses, the opportunities for digitization are identified, allowing a clearer vision of the actions to be taken.

Also, according to Tihinen (2017), to better understand which processes bring the greatest potential to benefit from their digitization (*step 2* of the De Carolis' approach), it is important to evaluate the Key Performance Indicators (KPI) of each process. Data integration makes the planning process of digitization easier, faster and more agile through the accurate evaluation of process data (Stoldt et al. 2018), being possible to conclude that it is necessary to develop tools to help this step. Data integration is the process of handling data from different sources (Bansal 2014). There are several platforms for dealing with data, and the Microsoft Power Platform is one of these, featuring a simple and intuitive interface that integrates artificial intelligence. This software is composed of four distinct applications, Power Apps, Power BI, Power Automate and Virtual Agents. (Abrahamyan et al. 2021; Nanda and Kumar 2021)

Some authors have pointed out some recommendations for success in the digital transformation process, highlighting the definition of an action plan based on the strategy of the company, and the alignment between the objectives and the strategy of the company (Ullrich et al. 2019; Zaoui and Souissi 2020).

Because the digital world is constantly changing, this digital transformation must take place in stages, ("Think a Series of Sprints, not Marathons", (Westerman et al. 2014)), being one of the reasons that it is important to choose the processes to digitize in phases and not everything in once. The impact of these changes on the company's strategic objectives must be constantly assessed (Westerman et al. 2014), which justifies the need for development of digital tools that support the roadmap for digitization.

This digitization can be carried out in both production and administrative processes (Hicks 2007). Consequently , and for that, the processes must be mapped and analysed, to understand their current state and to evaluate the waste, in order to idealize their future state (Bevilacqua et al. 2015). This mapping can be done using Business Process Model and Notation (BPMN) since it is a simple and intuitive language that allows the representation and modelling of a company's processes (Zarour et al. 2020).

This modelling must be done in phases, firstly, the process as it is currently done must be represented, using the as-is model, and secondly, the future state must be represented, that which is intended to be achieved in the future, using the to-be model, taking into account that the company's long-term objectives must be considered in this transition (Koszela 2016). LIM (Lean Information Management) is the methodology used for the improvement of information processes (administrative), to eliminate waste in information flows and, consequently, to obtain more value and knowledge from information (Bevilacqua et al. 2015). In this digital transition, LIM can be used to evaluate processes and eliminate waste in information, thus arriving at a more agile process, the future state.

The company where the project was developed concluded about the need to innovate and optimize processes. Hence the question: "Which processes should be digitized?", being this the starting point for the project presented below, i.e., to decide among a multitude of opportunities of processes to be digitized, which ones will benefit more from this transformation, according to the long-term objectives of the company.

After analyzing the literature, it was noticeable that there is a shortage of digital tools that support this digital transformation process, also concluding that it is important to define objectives and an action plan based on the company's strategy to succeed in this journey. Thus, this study aims to fill this gap in the literature with a tool that supports this transition, for which an application was developed through the Microsoft Power Platform software, which has been named DiYD (Do it Yourself Digitalization).

For this purpose, SharePoint was used for data storage and an app-like tool was created through Microsoft's Power Platform functionalities. This tool then allows the introduction of new ideas and opportunities for processes to be digitized, which speeds up the flow of selecting those that should move forward, defining this way an action plan for this journey. Also, this tool allows the users to extract information about objectives that they defined (according to the strategy of the company), to understand their state in the digital transformation path. It should be noted that the tool was tested and used in a collaborative environment, involving future users, which allowed the triggering of some adjustments to the initial version of the application.

In addition, meetings were held with departments, which showed that there is a huge need for the digitalization of processes that support administration and management, enabling the treatment and collection of data in a much more agile and precise manner.

2. Practical Study

2.1. Goals and Methodology

The present study was conducted in the operational excellence area of a Portuguese company operating in the construction sector and based in approximately 70 countries.

As previously mentioned, digitalization is already considered an important requirement for those companies that want to achieve or maintain competitive advantages in the market. The company under analysis also felt this need, and developed a roadmap for this digital transformation, as this can be seen as a "key-requirement" for the success of this journey. As this transformation must be carried out in phases, it is important to understand, by analyzing the characteristics of the processes, which of them have the greatest potential benefit for the company. After analyzing the literature, it became clear that there is a lack of technological tools that support the roadmap for digitization, thus becoming the focus of this work. This tool supports the process of surveying and selecting the priority processes to move forward, being ranked using the ICE (Impact-Cost-Easiness) index.

Therefore, this article describes how the tool, in the form of an app, was developed based on Microsoft's Power Platform. This software suite, which encompasses Power Apps, Power BI and Power Automate, was chosen through analysis of the key features of the survey and selection process.

The tool was developed based on an agile methodology, which enables an agile and flexible workflow. The agile methodology has been strongly chosen by professional software developers from among a huge amount of alternatives (Govil & Sharma, 2022), thus emerging the concept of agile development. According to Ghezzi and Cavallo (2020), the agile development refers to the fact that agility is brought to the development of software, enabling interaction and incremental delivery of the work, with those who will be the users of the tool, a collaboration between developers and users (Thun et al. 2021). Thus, this methodology enables "applying previous knowledge while learning from current experience" (Ghezzi and Cavallo 2020), and can be characterized by its flexibility, speed, constant learning, its ability to respond quickly to change (adaptability), and early delivery, providing this way more value to the costumers (Ghezzi and Cavallo 2020; Grepon et al. 2022).

According (Grepon et al. 2022), this methodology is divided into 6 well-defined phases: Requirements; Design; Development; Testing; Deployment; Review. In short, this methodology consists of an iterative and incremental approach, whereas users evaluated and added requirements to the tool, these were implemented in the tool. After the completion of three iterations, the final model of the application was reached to which usability tests were applied. These tests were used with the purpose of understanding: the level of receptivity of the application by the users, the validation of the requirements defined by them, and the usefulness of the tool. At the end, the last adjustments were made, based on the comments filled in during the tests, thus arriving at the final app. The Figure 1 shows the steps followed to achieve the final goal.

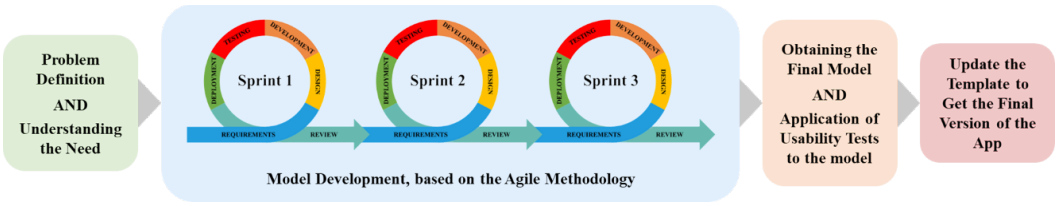

Figure 1: Steps to achieve the final app

2.2. Results and Discussion

2.2.1. Description of the solution from a conceptual perspective

As noted above, digitalization is already a requirement for companies that want to survive in the market. However, for this process to be successful, they must follow a well-defined methodology and a roadmap for digital transformation.

In the company where the work was developed, it was notorious the existence of processes that, besides not adding value for the consumers, consume unnecessary time for human resources. It was understood that it would be necessary to digitalize them, in order to make them efficient and effective processes. However, the digitalization of these processes could not occur simultaneously.

Consequently, it was concluded that this transformation would have to be done in a phased way, to manage human resources and available CAPEX (Capital Expenditure). Therefore, it was necessary to create a way to compile all the ideas of processes to be digitized and to choose the ones that presented priority to be digitized, through prioritization based on the ICE value, making this information processing a more agile way. The 15 processes that have the higher ICE value are going to be the first ones to be digitized.

It was then analyzed how this information should be processed in the tool, and the requirements were defined together with the users. The table below (Table 1) shows these requirements divided into different scopes.

Table 1. User's requirements

Principal Actions in the Systems	**Requirements**
Insert	– Add processes opportunities to digitize; – Introduce the characteristics of the process: name, description, department to which it belongs (commercial, environment-health-security, financial, marketing, operations, human resources, general), the existence of solutions on the market, the tools currently used (paper, e-mail, SAP, excel, others), among others; – Evaluate the process as to: the frequency of use (per year), the number of employees involved, the number of handovers (number of departments in which the process is involved); and the current average duration of a flow (of a realization in calendar days); – Calculate the value of the ICE index, an indicator according to which processes are prioritized, automatically.
Consult	– Manage all the processes so far introduced into the system; – Sort the list of processes according to the value of the ICE index; – Search the processes by name.
Specify	– Possibility of adding all the tasks corresponding to the process previously selected, characterizing each one of them with name, description, who performs them, the duration before the improvements, estimated duration after the improvements, the type of task (waiting, moving, verifying, stock, non-applicable), associated problem, what must be done to improve before scanning in the transition between the BPMN of the current state and the future state (eliminate, combine, reduce, simplify, non-applicable), ideas found;

	– Edit, view, and delete task records; – Model process by attaching files containing the BPMN of the current state and future state.
Delete	– Possibility of deleting records of processes.
Edit and View	– Chance to edit and view the records already made.
Files	– For those processes that are ready to move on to the digitalization itself, a file should be prepared to contain the information regarding the respective name, description, and a table with the associated tasks.
Help	– Download a pdf file of the guide for using the tool; – Possibility to send an email to the administrator if you need individualized help.
Parameterize ICE	– Chance of parameterizing the values corresponding to the parameters' impact, cost and easiness, according to the characteristics of each process (frequency of execution, the number of collaborators involved, the number of passages of testimony; and the current average duration of a flow), to choose which of them have an impact on the parameters and the associated level.
Performance Indicators	– Capacity to measure the performance indicators necessary to assess the status of the digitization project, in terms of the number of cases inserted by department, and in terms of their status (listed, selected, specified, under implementation, digitalized).
General	– Save all data in SharePoint.

2.2.2. Description of the solution from a technological and user perspective

As previously mentioned, the focus of this work is to describe how the final version of a technological tool (app) was achieved, which intends to support the roadmap for digitalization regarding the process of collecting and selecting opportunities of processes to be digitalized, having as a basis and prerequisite for this digital transformation, the Lean philosophy. For the development of this tool, the Microsoft Power Platform software was chosen, and during this development, an Agile methodology was followed to reach in a more efficient way the final objective.

After analyzing all the requirements stated by the users (Table 1), it was necessary to develop the architecture of the tool, explain the way how it should behave and its structure, and also demonstrate how the physical elements relate to each other. Each type of user has their tasks inside the tool, which are described in the figure, delineated by the dotted line. The tool in the form of an app was, then developed with Microsoft Power Platform software, utilizing Power Apps, Power Automate, and Power BI, and the database where the data is being stored in SharePoint. This architecture is illustrated in the figure bellow, Figure 2.

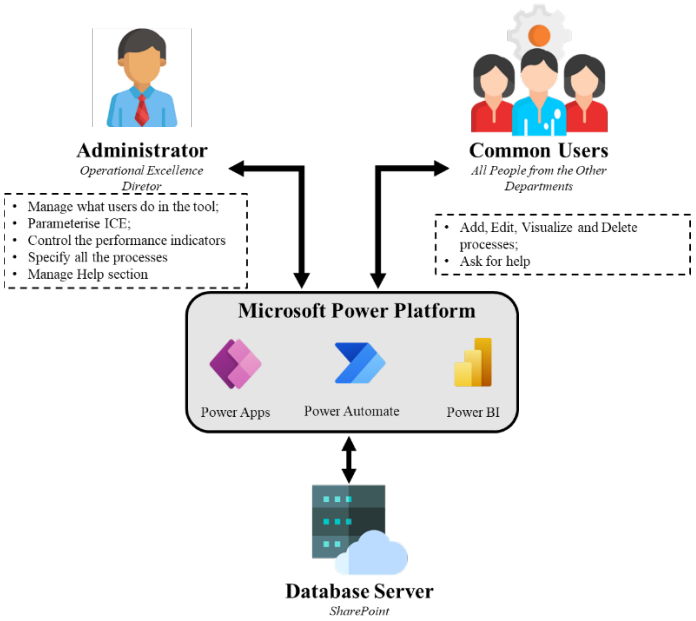

Figure 2. Tool architecture of the DiYD tool

Microsoft Power Platform was then the chosen software to satisfy the users' requirements, since it is flexible, with a great capacity to analyze and cross-reference data, user-friendly (intuitive and simple to use), and low code (making the developer's work fast and efficient) (Abrahamyan et al., 2021; Nanda & Kumar, 2021).

To explain the tool from a technological point of view, each of the steps to achieve the final goal/app (figure 1), will be addressed.

In requirements phase, some meetings were held with people who know about this topic, to facilitate the development of the user interface. From these successive meetings, the requirements, previously listed in Table 1, were extracted.

After analyzing the requirements, in the design phases, a class diagram was drawn up, which is schematized in Figure 3, which aims to describe the logical structure of how the data would be stored, organized, and manipulated in SharePoint, thus representing the system's database. Also, the architecture of the tool was developed, which is represented in Figure 2.

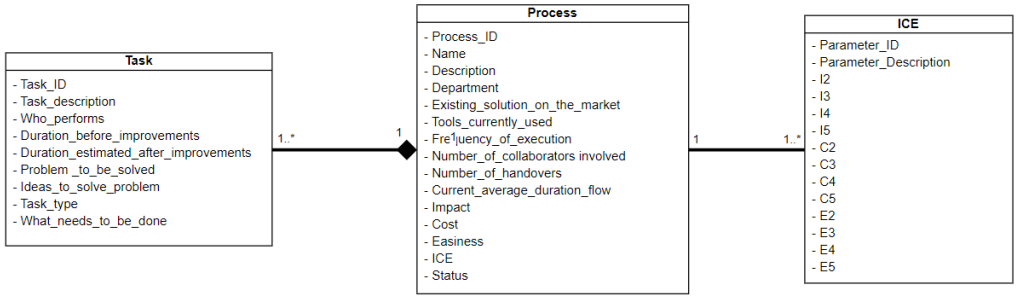

Figure 3. Class diagram of the tool

The systems way then developed in the power apps software, also integrating power automate and power BI. Power Apps, where the tool itself was elaborated, enable the interaction of the users with the system, while power automate

allows an automatic flow to take place and power BI enables the analysis of the indicators that can be measured through the tool.

The tool can be used by 2 types of users: the regular users (staff from all departments) and the administrator (director of operational excellence). Each of them has different functions in the app. Regular users can insert, edit, view, and delete processes, consult the user guide, and send eventual requests for help by email. The administrator is allowed to do everything that other users do, manage the processes inserted by other users, parameterize the values of the ICE index, control the performance indicators, which allow them to assess the status of the digitalization project, the specification of each of the processes selected, and also manage the help requests made by common users. Some of the screens in the app will be shown below, along with an explanation of what each one represents. These interfaces, which are presented below, are the result of the development and were confirmed by usability tests.

Figure 4. Initial menu containing the important modules of the system (first screen of the system)

The initial menu (Figure 4) is the main entrance to access the content of the app. This menu is open to all the users, and it contains the important modules of the system: “Add Process”; “Processes”; “ICE Index”; “Performance Indicators”; and “Help”.

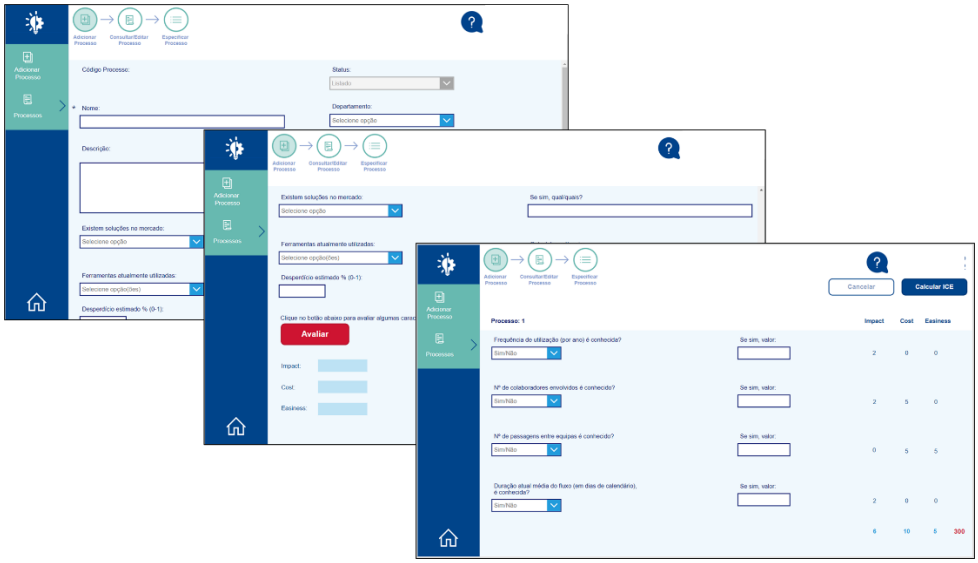

Figure 5. Add process module containing the blank spaces to fill the characteristics of the processes that constitute opportunities for digitalization

The Add Process Module as shown in Figure 5 above, represents the screen where the users can add opportunities of processes that can be digitized. After filling in all the information regarding the respective process, it is important to

evaluate it, to calculate the ICE value. The third picture shows the screen where the characteristics of the process, that are used to calculate this ICE value, (parameterized in the screen of Figure 10) can be filled.

Figure 6. Processes module, where it is possible to see and manage all the processes inserted by the users

Figure 6 shows the Process Module of the tool, that enables the user to see all the processes that were inserted. This screen is divided into 4 components:

1- **Search and sort zone** (surrounded in black in Figure 6), here it can be searched the process by its name and sort according to the ICE index;
2- **Record deletion zone** (surrounded in black in Figure 6), by clicking in the trash icon, it is possible to delete the process icon;
3- **Editing and revision zone** (surrounded in pink in Figure 6), by pushing the arrows icon, the process can be revised and/or edited, saving the changes at the end;
4- **Specification and modelling zone** (circled in red in the previous Figure 6), it is possible to specify and model the process by submitting an initial and final BPMN of the respective process.

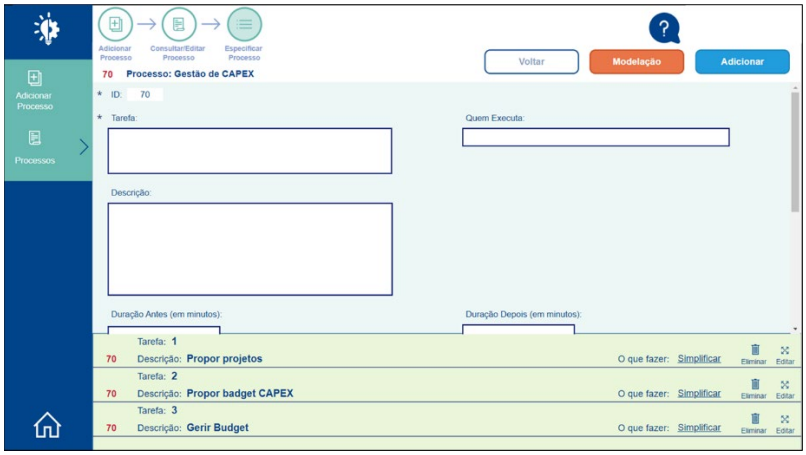

Figure 7. Process specification module, where the user can insert the tasks referring to the process chosen to specification

In the Figure 7 is represented the Process Specification Module, where the user can add, eliminate and edit tasks to the process chosen to be specified. After that, it is possible to model that same process, by clicking on the orange button. The screen resultant from pushing that button is shown below in Figure 8.

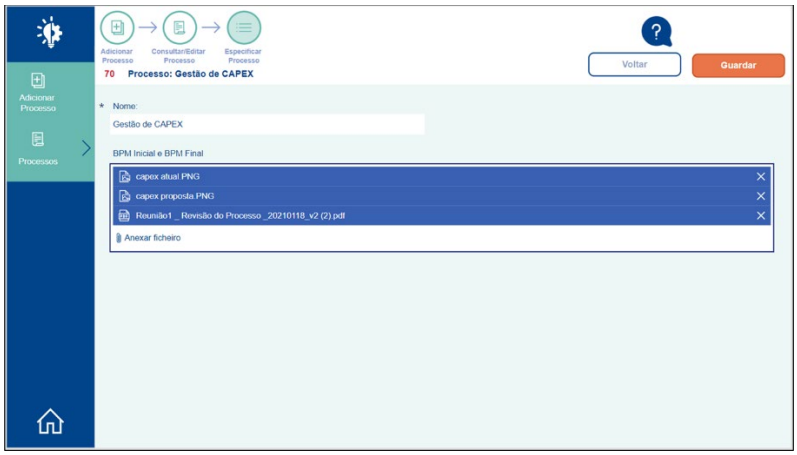

Figure 8. Process modelling module, where the user can insert the files with BPMN of the actual and the future state of the process chosen

Figure 8 represents the screen where the BPMN files from the actual state and the future state of the processes can be attached, completing this way the process modeling. To develop the future state of the process, it is used Lean Information Management to first delete the information waste and then find a new way to execute the same process.

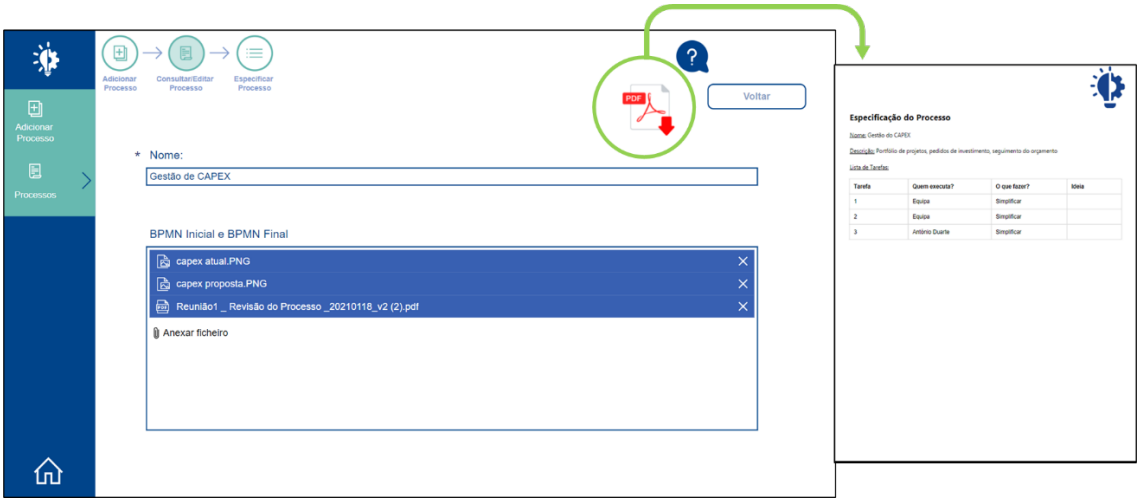

Figure 9. Module for obtaining the files with the process specification

The figure above, Figure 9 is representing the screen in which a file with some characteristics of the process and the associated tasks can be automatically elaborated. By clicking the button surrounded in green, a flow created in power automate is triggered, allowing the creation of a pdf file (right side of Figure 9) and stored in a SharePoint folder. This file is created to be easier to show the information regarding that process, to the people involved in this project. Also, on this screen, it can be possible to download the BPMNs attached before.

Digitalization can be either outsourced or made by the IT department of the company. By having all the information concentrated in just one place, it is easier to understand the actual state of the process and the desired future state, to facilitate its digital transformation.

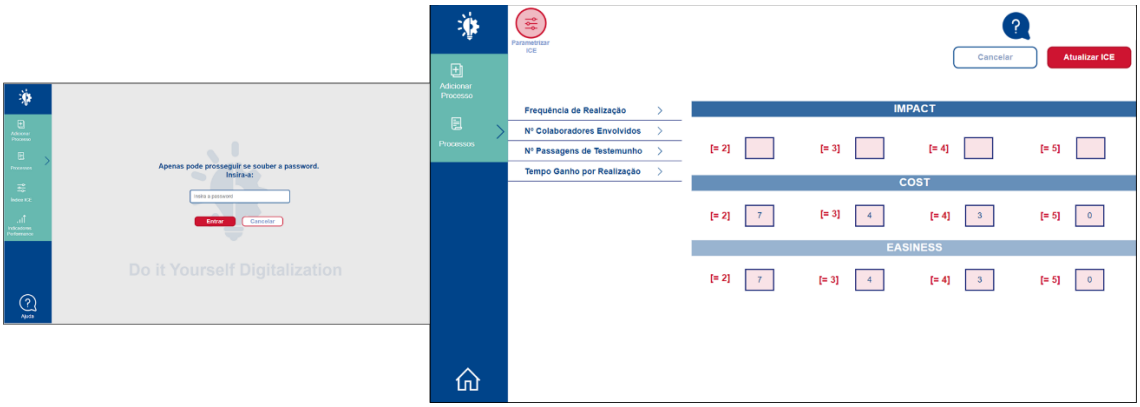

Figure 10. ICE index module, where the index can be parametrized according to the objectives of the company

Considering that the parameterization of the ICE index is only made by the administrator, it was necessary to ask the user to introduce a password to enter this field, as shown in the left part of Figure 10.

On the other hand, the right part of Figure 10 shows the screen where the ICE index can be parameterized, by completing the pink boxes, for each characteristic of the process. With these values and comparing them with the values inserted by the users in the moment of evaluating the process, it is possible to calculate automatically the ICE value corresponding.

Figure 11. Performance indicators dashboard, where it is possible to obtain the values of the indicators to evaluate the digital transformation

Performance Indicator Dashboard, as shown in Figure 11 is the module where the administrator can evaluate the indicators of the digitalization project, by consulting the number of processes corresponding to each status (listed, selected, specified, under implementation, digitalized) and each department (commercial, environment-health-security, financial, marketing, operations, human resources, general). This dashboard was developed in power BI and then was inserted in this screen, to facilitate the consult of the KPIs of digital transformation project.

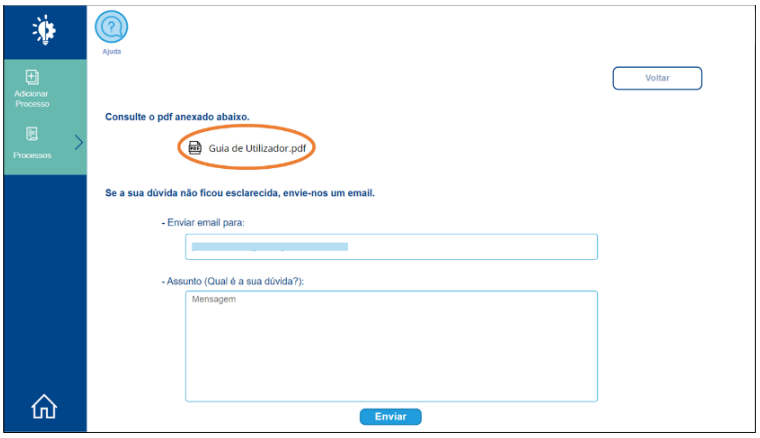

Figure 12. Help module, where the user's guide can be download and a message can be sent to the administrator of the system asking for help

Figure 12 shows the Help Module, in which is possible to download the User Guide, by clicking on the name surrounded in orange. Also, if the user has a doubt that cannot be solved by seeing the user guide, he/she can send an email to the administrator of the tool by writing a message and pushing the blue button.

During the execution and development phase of the tool, successive meetings were held with the tool administrator, in the testing phase. At these meetings, the implementations requested before were validated, and new requirements and adjustments to what had already been prepared also emerged and were updated immediately afterward. All the updates were done online already in the testing environment, ensuring that all the problems that came up were solved in a more practical way.

2.2.3. Usability Tests

After arriving at the final version of the tool, each of the future users was trained to use the application.

Upon completion of this training, and thus closing the system, users were subjected to individual usability tests to validate the requirements mentioned by them; verify the degree of receptivity of the app use, and verify its usefulness in the digitalization journey. These tests included: a set of tasks to be performed by users; a questionnaire about the most structural characteristics of the tool, and an evaluation by the observer, to understand the ease with which the test was done.

The results of these tests show not only that all requirements were met, but also, and by the comments during use, that this tool will be useful in digitization, in that it will help them draw a plan to reach the final goal, to have digitized processes. Furthermore, it was possible to conclude that some of the functionalities of the system would be more complicated to execute than others, so in the more difficult one changes were made, according to the comments made by future users, prefacing the screenshots presented above, between Figure 4 and 12.

In conclusion, it was understood, by analyzing the results of the usability tests, that the users were satisfied with the final result of the DiYD app, thus demonstrating the contribution of this work to the company.

3. Final remarks and future work

It is already common sense that digitization is increasingly a requirement for those companies that want to achieve a competitive advantage in the market, and that these are companies that must already have a certain level of maturity of the lean philosophy.

It was also possible to conclude, based on literature, that some challenges are faced by companies in this quest for digitalization. To overcome some of these challenges companies must develop a roadmap that allows them to organize and monitor this transition. In addition, to succeed in this process, companies must have tools that support this transformation, making it more agile and faster.

This work contributes to filling the gap in the literature about tools that support the roadmap for digitalization, as it presents a technological solution to help the execution of an action plan, through the conclusion of which processes should be digitized. For this, an app was developed using the software Microsoft Power Platform.

With this app, it is possible to reach this action plan by prioritizing processes according to the corresponding ICE index value, which is previously parameterized by the company, to be aligned with its long-term strategy. Furthermore, it enables the evaluation of indicators (KPIs) which are also defined in accordance with the organization's strategy, to understand the current state of the company compared to what it intends to achieve.

Even though this study fills a literature gap, it also has limitations, namely the fact that the case study was carried out in a company of a specific context of industry, so there is no guarantee that it can be applied to organizations operating in different contexts.

For the reason stated above, it would be interesting, as future work, to validate the tool in other types of industry sectors since it was only created considering a single organization from a single sector.

References

Abrahamyan, G., Atayan, A., Sharabaeva, L., and Gureva, T., Model of an intelligent system for managing the process of developing the competencies of industrial enterprise employee's competencies, *Journal of Physics: Conference Series*, vol. 2001, no. 1, 2021.

Antonucci, Y. L., Fortune, A., and Kirchmer, M., An examination of associations between business process management capabilities and the benefits of digitalization: all capabilities are not equal, *Business Process Management Journal*, vol. 27, no. 1, pp. 124–144, 2021.

Bansal, S. K., Towards a Semantic Extract-Transform-Load (ETL) framework for big data integration, *Proceedings - 2014 IEEE International Congress on Big Data, BigData Congress 2014*, pp. 522–529, 2014.

Bevilacqua, M., Ciarapica, F. E., and Paciarotti, C., Implementing lean information management: The case study of an automotive company, *Production Planning and Control*, vol. 26, no. 10, pp. 753–768, 2015.

Butt, J., A conceptual framework to support digital transformation in manufacturing using an integrated business process management approach, *Designs*, vol. 4, no. 3, pp. 1–39, 2020.

De Carolis, A., Macchi, M., Negri, E., and Terzi, S., Guiding manufacturing companies towards digitalization, *2017 International Conference on Engineering, Technology and Innovation: Management Beyond 2020: New Challenges, New Approaches, ICE/ITMC 2017 - Proceedings*, pp. 487–495, 2018.

Ghezzi, A., and Cavallo, A., Agile Business Model Innovation in Digital Entrepreneurship: Lean Startup Approaches, *Journal of Business Research*, *110*(June), pp. 519–537, 2020.

Ghobakhloo, M., The future of manufacturing industry: a strategic roadmap toward Industry 4.0, *Journal of Manufacturing Technology Management*, vol. 29, no. 6, pp. 910–936, 2018.

Govil, N., & Sharma, A., Validation of agile methodology as ideal software development process using Fuzzy-TOPSIS method, *Advances in Engineering Software*, vol. 168, pp. 103125, 2022.

Grepon, B. G., Baran, N., Gumonan, K. M. V., Martinez, A. L., and Lacsa, M. L., Designing and Implementing e-School Systems: An Information Systems Approach to School Management of a Community College in Northern Mindanao, Philippines, *International Journal of Computing Sciences Research*, vol. 6, pp. 792–808., 2022.

Hicks, B. J., Lean information management: Understanding and eliminating waste. *International Journal of Information Management*, vol. 27, no. 4, pp. 233–249, 2007.

Issa, A., Hatiboglu, B., Bildstein, A., and Bauernhansl, T., Industrie 4.0 roadmap: Framework for digital transformation based on the concepts of capability maturity and alignment, *Procedia CIRP*, vol. 72, pp. 973–978, 2018.

Koszela, J., Business process modeling for processing classified documents using RFID technology, *MATEC Web of Conferences*, vol. 76, pp. 1–5, 2016.

Mahraz, M. I., Benabbou, L., and Berrado, A., A systematic literature review of digital transformation, *Proceedings of the International Conference on Industrial Engineering and Operations Management*, pp. 917–931, 2019.

Nanda, M., and Kumar, A., Workflow Automation of Routing Rules in the Accounting Process for Online Travel Agency, *2021 9th International Conference on Reliability, Infocom Technologies and Optimization (Trends and Future Directions), ICRITO 2021*, pp. 1–5, 2021.

Reuschl, A. J., Deist, M. K., and Maalaoui, A., Digital transformation during a pandemic: Stretching the organizational

elasticity, *Journal of Business Research*, vol. 144, pp. 1320–1332, 2022.
Salvadorinho, J., and Teixeira, L., Organizational knowledge in the I4.0 using BPMN: A case study, *Procedia Computer Science*, vol. 181, no. 2019, pp. 981–988, 2021.
Stoldt, J., Trapp, T. U., Toussaint, S., Süße, M., Schlegel, A., and Putz, M., Planning for Digitalisation in SMEs using Tools of the Digital Factory. *Procedia CIRP*, vol. 72, pp. 179–184, 2018.
Tambare, P., Meshram, C., Lee, C. C., Ramteke, R. J., and Imoize, A. L., Performance measurement system and quality management in data-driven industry 4.0: A revie, *Sensors*, vol. 22, no. 1, pp. 1–25, 2022.
Thun, S., Bakås, O., and Storholmen, T. C. B., Development and implementation processes of digitalization in engineer-to-order manufacturing: enablers and barriers, *AI and Society*, vol. 37, no. 2, pp. 725–743, 2021.
Tihinen, M., Kääriäinen, J., Teppola, S., and Parviainen, P., Tackling the digitalization challange: how to benefit from digitalization in practice, *International Journal of Information Systems and Project Management*, vol. 5, no. 1, pp. 63–77, 2017.
Ullrich, A., Enke, J., Teichmann, M., Kreß, A., and Gronau, N., Audit - And then what? A roadmap for digitization of learning factories, *Procedia Manufacturing*, vol. 31, pp. 162–168, 2019.
Vigren, O., Kadefors, A., and Eriksson, K., Digitalization, innovation capabilities and absorptive capacity in the Swedish real estate ecosystem, *Facilities*, vol. 40, no. 15–16, pp. 89–106, 2022.
Westerman, G., Bonnet, D., and McAfee, A., Leading Digital, *Harvard Business Review Press*, pp. 303, 2014.
Zaoui, F., and Souissi, N., Roadmap for digital transformation: A literature review, *Procedia Computer Science*, vol. 175, pp. 621–628, 2020.
Zarour, K., Benmerzoug, D., Guermouche, N., and Drira, K., A systematic literature review on BPMN extensions, *Business Process Management Journal*, vol. *26*, no. 6, pp. 1473–1503, 202.

Acknowledgements
This work was supported by Portuguese funds through the Institute of Electronics and Informatics Engineering of Aveiro (IEETA) (UIDB/00127/2020) and research unit on Governance, Competitiveness and Public Policy (UIDB/04058/2020), both funded by national funds through FCT - Fundação para a Ciência e a Tecnologia.

Biographies

Juliana Basulo Ribeiro graduated in Industrial Engineering and Management in 2020, from the University of Aveiro and is currently a master's student in the same area, at the same university. Also, as part of her master's degree she took part in the ERASMUS program, studying in Sweden, at Linköping University. To conclude the master's degree, she is integrated in the development of a project of digitalization and dematerialization of processes in a Portuguese company, with the aim of understanding how the combination between Lean Management technologies (strongly applied in western industry), BPM and Industry 4.0 can help companies to reach a completely different level of excellence.

Marlene Amorim is Assistant professor at the Department of Economics, Management, Industrial Engineering and Tourism at the University of Aveiro, Portugal and a member of the Research Unit in Governance Competitiveness and Public Policies (GOVCOPP). She served the University as Pro-rector for Internationalization from 2014 to 2018, and as Director and then Vice-Director for the Master in Industrial Engineering and Management. Currently she serves as Coordinator for the research line in Competitiveness Innovation and Public Policies at GOVCOPP. Marlene received her PhD in Management from IESE Business School of University of Navarra in Spain, and conducts research in the area of service operations and service quality, notably in topics related to service process design and customer participation in service delivery. She has authored over 100 publications in peer reviewed journals, conferences and books, and is responsible for the Coordination of several international projects (ERASMUS+, URBACT).

Leonor Teixeira graduated in Industrial Engineering and Management, received a MSc. degree in Information Management, and a PhD in Industrial Management (Information Systems area), in 2008, from the University of Aveiro, Portugal. She is currently an Associate Professor of the Department of Economics, Management, Industrial Engineering and Tourism (DEGEIT) at the University of Aveiro. She is also a researcher (Integrated Member) at the Institute of Electronics and Informatics Engineering (IEETA) / Intelligent Systems Associate Laboratory (LASI) and collaborator at research unit on Competitiveness, Governance and Public Policies (GOVCOPP) of University of Aveiro. Her current research interests include Industrial Management in general, and in Information Systems applied

to Industry in particular. She has over 200 publications in peer-reviewed journals, book chapters and proceedings, and has several communications at international scientific conferences, some of which as invited speaker. She serves as a member of Program Board and Organizing Committees for several Scientific Committees of International Conferences and has collaborated as reviewer with several journals. She is associated with IIIS and APSI/PTAIS.