

CENTERIS - International Conference on ENTERprise Information Systems / ProjMAN - International Conference on Project MANagement / HCist - International Conference on Health and Social Care Information Systems and Technologies 2021

## Project management maturity in the biotechnology industry

Micaela Martins <sup>a</sup>, Cláudia Sousa e Silva <sup>b\*</sup>, José Magano <sup>c</sup>

<sup>a</sup>University of Aveiro, Campus Universitário de Santiago, 3810-193 Aveiro, Portugal

<sup>b</sup>Research Unit on Governance, Competitiveness and Public Policies (GOVCOPP), DEGEIT, University of Aveiro, Campus Universitário de Santiago, 3810-193 Aveiro, Portugal

<sup>c</sup>Research Center in Business and Economics (CICEE), Universidade Autónoma de Lisboa, Rua Sta. Marta 47, 5.º Andar, 1150-293 Lisboa, Portugal

<sup>e</sup>ISCET-High Institute of Business Sciences and Tourism, Rua de Cedofeita, 285, 4050-180 Porto, Portugal

---

### Abstract

This paper contributes to the development of project management in companies that integrate biotechnology in their processes, given the increasing importance of this sector under the current context. The main goal is to assess project management maturity in a sample of companies that involve biotechnology processes, identifying their main weaknesses and strengths in project management. A quantitative approach was applied by analyzing the data collected through a questionnaire structured with the K-PMMM Level 2.

This work allowed to diagnose 96 companies of this emerging sector, still scarcely studied as concerns project management. All participating companies recognized the importance of project management, however there are still several steps to consolidate the evaluated project management practices, once only about 12,5% reached the whole five life cycle phases of project management maturity.

The originality of this work relies on the structure of the data analysis that allowed to highlight the multidimensional and simultaneous perspective of the project management maturity process. That is, a process that recognizing the need and added value of project management, implementing methodologies and tools, and having the executive and line management support. These factors must be taken care of in parallel to evolve the organization's capacities to manage its projects consistently and long term. The study revealed that part of the participating companies meets this simultaneous multidimensional approach, although still very incompletely.

© 2021 The Authors. Published by Elsevier B.V.

This is an open access article under the CC BY-NC-ND license (<https://creativecommons.org/licenses/by-nc-nd/4.0>)

Peer-review under responsibility of the scientific committee of the CENTERIS –International Conference on ENTERprise Information Systems / ProjMAN - International Conference on Project MANagement / HCist - International Conference on Health and Social Care Information Systems and Technologies 2021

---

\* Corresponding author. Tel.: +351 234 370 361

E-mail address: [claudia.margarida@ua.pt](mailto:claudia.margarida@ua.pt)

*Keywords:* Project management maturity; Biotechnology project; life cycle phases of project management maturity.

---

## 1. Introduction

Biotechnology is one of the most promising emerging technological areas integrated in many industries, such as pharmaceutical and healthcare, chemical, and energy, among others [1,2]. In addition, the biotechnology industry allows improving the quality of human life, helping to overcome numerous adversities, such as the Sars-COV-2 pandemic [3].

Therefore, Biotechnology projects' success is increasingly relevant, however according to Harpum, P. [4], relying on project management from an internal perspective is insufficient, and it is also necessary to manage external factors. As such, organizations will need to adopt project management methods and practices to successfully conduct a project with an impact on business' strategic results. Nevertheless, several organizations having difficulties implementing or improving their abilities in project management. To overcome this problem, an increasing interest in methods that assess and improve project management maturity (PMM) has gained visibility and importance in organizations and research field [5,6].

PMM is directly related to the organization's ability to manage its projects [7]. Thus, the evaluation of organization's PMM allows to identify and analyze the strengths and weaknesses of the management processes and methods and allows the comparison between organizations [8]. Due to the external organizational environment, companies cannot evolve and improve in isolation, making it crucial to assign value to the PMM benchmark [5].

Among 60 articles selected between 2017-2020, (in a previous systematic literature review carried out, through Scopus, Science Direct, and Web of Science, using the search path "Project Management Maturity Model") thirteen involved the application of maturity models in several sectors, although none in biotechnology; hence, the opportunity and incentive developing this study.

This work intends to deepen and contribute to the development of project management knowledge, specifically in the biotechnology area. So, the main research question is "What is the PMM level in the biotechnology industry, given the emergence and the importance of projects' success in the current context?" Thus, the following objectives are defined:

- Characterize the companies that integrate biotech located in Portugal participating in the study.
- Characterize the professionals who carry out projects in these companies.
- Assess the project management maturity of the participating companies and identify the main strengths and weaknesses in project management.

## 2. Literature review

The biotechnological projects are highly specialized, need specific competencies, and involve advanced scientific work, which takes a significant time to be mastered. It is increasingly urgent to quickly develop this kind of projects with successful results, leading to the "abandonment" of traditional management methods to implement an approach that emphasizes the value of knowledge and innovation [9]. Project Management has been identified as a facilitator to conduct complex challenges, promoting organizational change [10,11].

Project management allows organizations, through an organizational strategy, to have more security and confidence, acquiring sustainable competitive advantage, and reaching high levels of performance and productivity, while motivating teams [5,12,13]. Thus, adopting methods for evaluating and improving its PMM is crucial to lead the projects and the organization to success [5,6].

## 2.1. Project management maturity (PMM)

Many organizations are unaware of their PMM status and lack a clear orientation regarding an adequate evolving path [5,8].

Kerzner described maturity as the development of processes and structures in the organization, which are repeated naturally and allow the success of projects [11,14]. The maturity in project management indicates whether the organization can effectively manage them [15]. In this way, the PMM assessment provides a new approach to project management that facilitates decision-making and enhances the organization's competencies [16].

In an organizational context, it shows that the maturity of project management leads to benefits in reducing project delivery costs and improving productivity, operational efficiency, intimacy with the client, and increasing the organization's reputation [17].

The assessment of an organization's capabilities is essential for organizational learning and development [18]. Specifically, evaluating an organization's PMM allows identifying and analyzing the strengths and weaknesses of management processes and methods, also allowing the comparison between organizations [8]. The evaluation of maturity also improves communication between the project management community and top organizational management [15,19].

Since a higher level of maturity indicates better performance in project management, the correct use of project management maturity assessment models becomes crucial, allowing an organization "to raise awareness for potential development" [16,20]. More than 30 maturity assessment models are described and applied in levels, indicating the organization's position and identifying the areas to focus on to improve[5].

Considering comparative studies developed by several authors [12,15,21], the following models of project management maturity assessment models were identified: OPM3; CMM, K-PMMM, P3M3, and MINCE.

Farrokh and Mansur [21] compared the models mentioned above in terms of structure, integrated dimensions, theoretical basis, and associated performance indicators. Khoshgoftar and Osman [15] made an exhaustive comparison that included 26 comparative criteria, namely, maturity levels, ease of access, usage costs, scope, and the standard of support, among many others. Silva, D. R. [12] relied on a structured analysis around the advantages and disadvantages of each project management maturity model.

## 2.2. Kerzner's K-PMMM [14]

The selection of the model is a crucial process, being necessary to pay attention to the application context, the projects and how they are managed (if it extends to portfolios and programs) and the organization as a whole [22]. Based on the comparative studies referred to above [12,15,21] Harold Kerzner's K-PMMM [14] stands out, since it has a theoretical basis, uses a discrete scale with results tangible, detailed, easily accessible, and without acquisition costs. It also allows identifying strengths and weaknesses, is focused on the perspective of continuous improvement, simple to understand, and easy to implement.

Harold Kerzner's model is an extension of CMM, however with five levels of maturity [14,23]: Level 1 "Common Language"; Level 2 "Common Processes", Level 3 "Singular Methodology", Level 4 "Benchmarking", Level 5 "Continuous Improvement". Considering a collection and analysis of published articles that applied Kerzner's K-PMMM [24-30], it was observed that levels 2 and 3 are the most used. This paper focuses only on data analysis related to level 2 since it is an initial assessment of the project management maturity, highlighting the weaknesses and strengths of organizations in this field.

Level 2 "Common Processes" of this maturity model, requires a good definition of the project management processes, it allows the organization to understand the common methodologies and processes for the success of the projects. This level is divided into five phases [14]:

- The first phase is the embryonic phase, in which the organization recognizes the need for project management and that it can benefit the organization, contributing to its added value. It acknowledges the application of project management to various business areas and recognizes what changes are needed to implement project management.
- Phase 2 is the acceptance by the executive management, with the benefits of project management being recognized at this management level. Executive management demonstrates its support in its implementation, understands

project management methodologies and processes, ensures the project's sponsorship, and believes that project management can change the organization's management.

- Phase 3 focuses on the acceptance by the line management through visible support at this level. It focuses on the training and commitment of middle managers and operational employees to project management.
- The growth phase, Phase 4, considering project life cycle management, the development of a methodology, the commitment to effective planning, and the use of adequate project management software.
- The fifth and final phase is the "initial maturity phase", where the development of cost control and scheduling management system is expected, preferably in an integrated manner, as well as a continued focus on training and development of project management skills.

### 3. Methods

#### 3.1. Instrument

Exploratory research was carried out to assess the PMM of the participating companies with biotech processes. To this end, a questionnaire based on Google Forms was developed, structured in two parts. The first one intended to collect demographic data from the participants and the organizations. The second part presented 20 questions drawn directly from Kerzner's model to assess the organization's maturity at different levels. A differentiating feature of this model is that an organization company can simultaneously register different scores at different maturity phases. The validity of the Kerzner 'scale was supported on other peer-reviewed studies [26-30].

The assessment of level 2 was based on those 20 questions divided in 5 phases, using a 7-point Likert scale (from -3 'Completely disagree' to 3 'Completely agree'). It subsequently led to a maximum score of 12 points in each phase per organization, scores equal to or greater than 6 indicate an organization has achieved an initial level of maturity [14]. One should keep in mind that companies can achieve portions of one phase parallel with another phase.

#### 3.2. Data collection and analysis

Two hundred and fifty organizations that integrated Biotechnology in their activities were selected and contacted via email, social networks, and phone for two and a half months. The questionnaire was addressed to staff involved in projects that integrate biotechnology, from project managers to team members. One hundred responses were obtained, and 96 valid responses were considered, representing a 38.4% response rate. The software used for data analysis were Microsoft Excel and IBM SPSS Statistics 26.

The reliability of the measurement scales was analyzed through an internal consistency coefficient, namely Cronbach alpha (Table 1). Alpha values greater than 0.700 indicate that there is internal consistency and that the items are consistent in measuring the same construct - in this case, the maturity of the organization [31].

A descriptive analysis was followed to characterize the participating companies located in Portugal that integrate biotechnology, characterize the professionals involved in their projects, and assess these companies' PMM.

### 4. Results

#### 4.1. Characterization of companies with biotechnology processes

The sample was very diverse concerning the predominant branches of biotechnology developed by organizations. The areas with the highest response rate were environmental and industrial biotechnology (26.04%) and plant biotechnology (20.83%). Molecular biotechnology, which includes molecular and cellular research, accounted for 16.67% of the sample, and other areas were less represented, such as medical devices molecular biotechnology, bioinformatics, bioengineering, bio-decontamination, food biotechnology, and pharmaceutical.

Most respondents (53.61%) were micro-companies (less than 10 workers), whereas 21.65% of the participants were small companies. These values were already expected since biotechnology is an area in which many research groups are embodied into micro-companies. All participating companies were in mainland Portugal and evenly

distributed in the country's North, Center, and South. Half of the sample (49.58%) were recent organizations operating in the market for less than ten years, 24.74% between 10 and 20 years, and the remain for over 20 years.

#### 4.2. Characterization of project management professionals

Nearly half (42.27%) of the respondents were in the 26-35 years old age group, followed by 36-45 (24.74%), and 18-25 and 46-55 (both with 16.49%). Approximately 95% of participants had higher education qualifications, 16.49% BSc, 37.11% MSc, 34.02% Ph.D., and 8.25% had postgraduate degrees.

However, 86.60% of the respondents did not hold any project management certification. Only 9.28% had the PMP PMI's certification, and 4.12% attending postgraduate courses that would allow them to obtain that certificate later. It was also possible to ascertain that 55.91% of the respondents had no academic training in project management.

20.62% of the participants had worked in their organization for less than 1 year, 24.74% between 1 to 5 years, 25.77% between 5 to 10 years and the remain more than 15 years. 8.25% of the respondents had less than one year of experience, whereas 38.14% had between 1 to 5 years, 16.49% between 5 to 10 years, 8.25% between 10 to 15 years, and 16.49% had more than 15 years. When involved in a project, most respondents acted as project managers (45.36%), coordinators (37.11%), and team members (17.53%).

Concerning other roles played in the organization, the respondents acted in corporate management (45.36%), operational management (16.49%), management (9.28%), engineering design (8.25%), marketing and sales (16.49%), research (4.12%), and no position, that is, respondents that were related exclusively to projects (12.37%).

#### 4.3. Project management maturity assessment K-PMMM Level 2

There was internal consistency ( $\alpha \geq 0.7$ ) in all questions of the scale level 2 - K-PMMM, and the questions of each phase of that same level (Table 1).

Table 1. Cronbach alpha for each instrument scale and sub-scale Level 2 – K-PMMM

Phases	No. of items	Cronbach alpha	Phases	No. of items	Cronbach alpha	Global
Embryonic	4	.936	Growth	4	.740	<b>.949</b>
Executive management	4	.883	Initial maturity	4	.831	
Line management	4	.749				

Figure 1 depicts the number of organizations that have reached each mentioned phase. Notably, phases can coexist as they evaluate distinct and complementary elements of project management (for example, an organization can be accounted for both the growth and initial maturity phases). The largest number of organizations have reached the growth stage (45.83%), whereas 37.5% reached the embryonic, executive, and line management phases. However, considering only the group of organizations that reached a particular stage (score  $\geq 6$ ), it appears that the embryonic phase is more consolidated (mean = 9.22), followed by the executive phase (mean = 8.67).

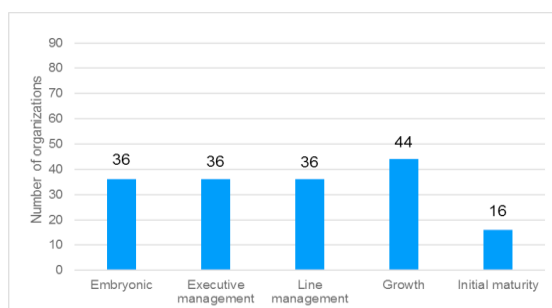


Fig. 1. Number of organizations per maturity Level 2 phases

Only 16 companies (16.67%) reached the initial maturity phase. Although fewer, these companies show considerable consolidation concerning the adopted project management practices (mean = 8.5). In this group, the analysis must be carried out in a cautious and complementary way. Despite being a phase that indicates initial maturity, the organization may not have the necessary foundations (for example, the acceptance of line management may not exist or the lack of recognition of the added value of project management), and consequently, a less consolidated maturity. Thus, the ideal would be for organizations to reach all Level 2 phases to become mature in project management. Interestingly, in this group of 16 companies, 12 reached the 5 phases, and only 4 reached 4 phases, leaving out the embryonic phase.

## 5. Discussion

The results reinforce the relevance of the research topic on project management in companies that integrate biotechnology. The companies participating in the study that integrate biotechnology act in very diversified areas. That diversity can be a stimulating factor for benchmarking the sector through maturity assessment models. In addition, more than half of the companies are micro or small companies with activity in the market for less than ten years, which signals the emergence of the industry.

As previously described, most participant professionals belong to generation Y, but a multigenerational environment as different age groups were significantly present. There was also a balanced distribution between less and more experienced professionals. The diversity in age groups and professional experience can be an interesting feature within a project team due to the potential for complementing profiles and skills [32]. However, most participants accumulate other functions, which can be an obstacle to project development projects, and were highly qualified, which was expected given the specificity of the industry. However, strangely enough, only about 10% have project management certification, and more than half have had no prior project management training.

More than half of the organizations have demonstrated the applicability and recognition of the project management value in their businesses. 58.33% have already achieved at least one phase of Level 2 (K-PMMM). However, from the perspective of project management maturity assessment, some gaps and steps still to be taken are identified, as 41.67% have not yet reached any phase of Level 2. In contrast, only 16.67% have managed to reach 4 phases. 12.50% reached all 5 phases, being the only ones are prepared to evolve in a consolidated manner in the management of their projects, enhancing success and continuous improvement of their results.

Based on the data presented above, phase 4 (growth) is the one that stands out the most due to the number of companies that have already reached it. Furthermore, it reveals that more companies focus primarily on implementing project management methodologies throughout their life cycle. Considering the responses of all participants, the most prominent item in phase 4 was the commitment to project planning (mean = 1.45), followed by the effort to minimize changes in the scope of the projects developed (mean = 1.08). However, the least consolidated item in phase 4 was regarding software adoption to support project management monitoring (mean = -0.125).

Regarding the embryonic phase (phase 1), the recognition of the need to adopt project management methods (mean = 1.0) and the benefits of implementing the project (mean = 1.08) is emphasized, and this recognition was also felt at the executive level. However, it is not so evident to participants that the executive management recognizes what must be done to achieve project management maturity (mean = 0.21).

Pointing the lens at the executive management (phase 2), the participating companies reach this stage due to the perception they have of the support of executives in the implementation of project management (mean = 1.25) through meetings and presentations in which they participate. Still, there was some consensus on the lack of understanding by the executive management of the sponsor concept and the inability to act as such (mean = 0.29).

The support of line management (phase 3) in the implementation of project management was highlighted (mean = 1.79), also recognizing the predisposition of these managers in making their employees available for management training (mean = 1.04). However, a strong gap was identified in project management training at the line management level (mean = -0.33).

As mentioned above, phase 5 is the one that includes the smallest number of companies and, consequently, its items have the lower mean values. Comparing the four items of that phase, one can observe some systematization in implementing cost and time control systems aligned with other systems already in place (mean = 0.83). However,

once again, the scarcity of training in project management to improve employees' skills stands out (mean = -0.79). There is also a gap in project management as a full-time function, which is rather seen as a part-time task (mean = -0.125). Table 2 summarizes the strengths and weaknesses in project management revealed by the companies of the sample that involve biotech projects.

Table 2. Project management strengths and weaknesses

Phases	Strengths	Weaknesses
1 - Embryonic	Recognition of the need to adopt project management's methods Recognition of the project management's benefits	Lack of recognition by executive management about what must be done to achieve project management maturity
2 - Executive management	Executive support in the implementation of project management	Executive management does not understand the concept of sponsor and therefore is unable to act as such
3- Line management	Support of line management in the implementation of project management	Lack of training in project management at the line management level
4 - Growth	Commitment to project planning Effort to minimize changes in project scope	Reduced adoption of software to support project management monitoring
5- Initial maturity	Some implementation of cost and time control systems aligned with other systems already in place	Lack of training Project management seen as a part-time job

## 6. Conclusion

This study assessed the project management maturity in 96 organizations that integrate biotechnology through applying Level 2 of Kerzner's PMMM. Some companies have already taken the maturity development path, with a greater emphasis on the initial concern with implementing methodologies linked to the management of project planning and scope. However, a significant percentage of the companies realized that the effective implementation of project management contemplates multiple factors that need to be integrated and consolidated in parallel. Therefore, this analysis from a multidimensional and overlapping perspective is very differentiating and important, as it allows developing the project management maturity in a more consistent and structured way.

However, the results allowed identifying gaps such as the lack of executive management's recognition of the changes to be implemented with project management, the visible lack of training at various management levels, considering project management as a part-time job, and reduced software adoption to support project management. Such gaps should help to outline the path towards the evolution of project management maturity. What are the variables that most contribute to these gaps? For example, does the predominant size of these companies (micro and small) impact maturity, given their structure? Or is the lack of professionals' academic and life-long project management training a determining factor in maturity?

Although the results reinforce the relevance of the research topic to those companies, the main limitation is that only one professional per company was involved in answering the questionnaire, and there aren't alternative perspectives from within each organization.

The ongoing research project will evolve to a more interactive approach that would likely generate other valuable data deepen analysis with correlation studies, exploring such questions to identify further the variables related to PMM in the biotechnology industry. Future contributions will comprise recommendations to companies to improve their ability to manage projects, creating value for themselves and society.

## References

- [1] Burrone, Esteban. (2006). "Patents at the core: the biotech business." WIPO World Intellectual Property Organization Website. [www.wipo.int/sme/en/documents/patents\\_biotech\\_fulltext.htm](http://www.wipo.int/sme/en/documents/patents_biotech_fulltext.htm) (Accessed 15-05-2021).
- [2] Commission, European. (2020). "Internal market, industry, entrepreneurship and SMEs." European Commission. [https://ec.europa.eu/growth/index\\_en](https://ec.europa.eu/growth/index_en) (Accessed 15-05-2021).
- [3] Europabio. (2013). "Biotechnology: How intellectual property rights promote innovation and create economic and societal value." Europabio. <http://m.bioin.or.kr/board.do?bid=system&num=240198&cmd=view&cPage=21&cate1=04&cate2=> (Accessed 15-05-2021).

- [4] Harpum, Pete. (2010). *Portfolio, program, and project management in the pharmaceutical and biotechnology industries*. New Jersey: John Wiley & Sons.
- [5] Grant, Kevin P, and James S Pennypacker. (2006) "Project management maturity: An assessment of project management capabilities among and between selected industries." *IEEE Transactions on engineering management* **53** (1): 59-68. <https://doi.org/10.1109/TEM.2005.861802>.
- [6] Tereso, Anabela, Pedro Ribeiro, Gabriela Fernandes, Isabel Loureiro, and Mafalda Ferreira. (2019) "Project management practices in private organizations." *Project Management Journal* **50** (1): 6-22. <https://doi.org/10.1177/8756972818810966>.
- [7] Vanucci, Luis Henrique Torquato, Ivan Furegato Moraes, Lilian Perrenoud, and Ary José Rocco Júnior. (2019) "Maturidade em gerenciamento de projetos: uma análise das empresas organizadoras de corridas de rua da cidade de São Paulo." *Revista de Gestão e Projetos* **10** (2). <https://doi.org/10.5585/gep.v10i2.11385>.
- [8] Ibbs, C William, and Young Hoon Kwak. (2000) "Assessing project management maturity." *Project management journal* **31** (1): 32-43. <https://doi.org/10.1177/875697280003100106>.
- [9] Terziovski, Milé, and John P Morgan. (2006) "Management practices and strategies to accelerate the innovation cycle in the biotechnology industry." *Technovation* **26** (5-6): 545-552. <https://doi.org/10.1016/j.technovation.2004.10.016>.
- [10] Cicmil, Svetlana, Terry Williams, Janice Thomas, and Damian Hodgson. (2006) "Rethinking project management: researching the actuality of projects." *International journal of project management* **24** (8): 675-686. <https://doi.org/10.1016/j.ijproman.2006.08.006>.
- [11] Kerzner, Harold. (2017). *Project management: a systems approach to planning, scheduling, and controlling*. New Jersey: John Wiley & Sons.
- [12] Silva, David Renato Macedo Alves da. (2014). "Projeto OPM3 Portugal: análise setorial de resultados aplicado à investigação da maturidade organizacional em Gestão de Projetos." University of Minho. <http://hdl.handle.net/1822/33443> (Accessed 15-05-2021).
- [13] PMI. (2013). *Project Management Maturity Model*. Pennsylvania: Project Management Institute.
- [14] Kerzner, Harold. (2019). *Using the project management maturity model: strategic planning for project management*. 3 ed. New Jersey: John Wiley & Sons.
- [15] Khoshgoftar, Mohammad, and Omar Osman. (2009). "Comparison of maturity models." *2009 2nd IEEE International Conference on Computer Science and Information Technology*.
- [16] Irfan, Muhammad, Mazlan Hassan, Nasruddin Hassan, Muhammad Habib, Salma Khan, and Abdul Muhaimin Nasruddin. (2020) "Project Management Maturity and Organizational Reputation: A Case Study of Public Sector Organizations." *IEEE Access* **8**: 73828-73842. <https://doi.org/10.1109/ACCESS.2020.2988511>.
- [17] Irfan, Muhammad, Mazlan Hassan, and Nasruddin Hassan. (2019) "The effect of project management capabilities on project success in Pakistan: An empirical investigation." *IEEE Access* **7**: 39417-39431. <https://doi.org/10.1109/ACCESS.2019.2906851>.
- [18] Mullaly, Mark. (2006) "Longitudinal analysis of project management maturity." *Project Management Journal* **37** (3): 62-73. <https://doi.org/10.1177/875697280603700307>.
- [19] Nenni, Maria Elena, Vincenzo Arnone, Paolo Boccadelli, and Iolanda Napolitano. (2014) "How to increase the value of the project management maturity model as a business-oriented framework." *International Journal of Engineering Business Management* **6**: 8. <https://doi.org/10.5772/58292>.
- [20] Gareeb, Natisha, and Pantaleo D Rwelamila. (2021) "Rethinking project management maturity models for the South African power sector." *African Journal of Science, Technology, Innovation and Development*: 1-15. <https://doi.org/10.1080/20421338.2021.1899558>.
- [21] Jaleel, F, and AK Mansur. (2013). "Project management maturity models and organizational project management maturity model (OPM3®): A critical morphological evaluation." *International Conference on Innovation, Technology and Knowledge Economy*.
- [22] Fabbro, Elisa, and Stefano Tonchia. (2021) "Project Management Maturity Models: Literature Review and New Developments." *The Journal of Modern Project Management* **8** (3). <https://www.journalmodernpm.com/index.php/jmpm/article/view/660>.
- [23] Kerzner, Harold. (2002). *Strategic planning for project management using a project management maturity model*. New York: John Wiley & Sons.
- [24] Hernández, FY, RI Laguado, and JP Rodriguez. (2018). "Maturity analysis in project management in Colombian universities." *Journal of Physics: Conference Series*.
- [25] Bolat, Bersam, Aslı Kuşdemir, İpek Ceren Uslu, and Gül Tekin Temur. (2017) "An assessment for IT project maturity levels." *International Journal of Information Technology Project Management (IJITPM)* **8** (2): 1-16. <https://doi.org/10.4018/IJITPM.2017040101>.
- [26] Bay, Achmad Fuad, and Martin Skitmore. (2006) "Project management maturity: some results from Indonesia." *Journal of Building and Construction Management* **10** (1): 1-5. <https://eprints.qut.edu.au/9413/>.
- [27] Ofori, Dan, and Eric Worlanyo Deffor. (2013) "Assessing project management maturity in Africa: A Ghanaian perspective." *International Journal of Business Administration* **4** (6): 41. <https://doi.org/dx.doi.org/10.5430/ijba.v4n6p41>.
- [28] Permana, Vicky, Yudho Giri Sucahyo, and Arfive Gandhi. (2017). "Measuring information technology project management maturity level: A case study from a project based organization in Indonesia." *2017 International Conference on Information Technology Systems and Innovation (ICITSI)*.
- [29] Berssaneti, Fernando Tobal, and Marly Monteiro Carvalho. (2015) "Identification of variables that impact project success in Brazilian companies." *International journal of project management* **33** (3): 638-649. <https://doi.org/10.1016/j.ijproman.2014.07.002>.
- [30] Yen, Wong Whee, Yeoh Kar Peng, and Yap Seok Gee. (2016). "A Case Study Assessment of Project Management Maturity Level in the Malaysia's IT Industry." *International Conference on Industrial Engineering and Operations Management*.
- [31] Maurício, Sandra, Isabel Rebêlo, Catarina Madeira, Filipa Resende, and Susana Esteves. (2021) "Validation of the Portuguese version of Amsterdam Preoperative Anxiety and Information Scale (APAIS)." *Health and Quality of Life Outcomes* **19** (1): 1-9. <https://doi.org/10.1186/s12955-021-01736-6>.
- [32] Magano, José, Cláudia Silva, Cláudia Figueiredo, Andreia Vitória, Teresa Nogueira, and Maria Alzira Pimenta Dinis. (2020) "Generation Z: Fitting Project Management Soft Skills Competencies—A Mixed-Method Approach." *Education Sciences* **10** (7): 187. <https://doi.org/https://doi.org/doi:10.3390/educsci10070187>.