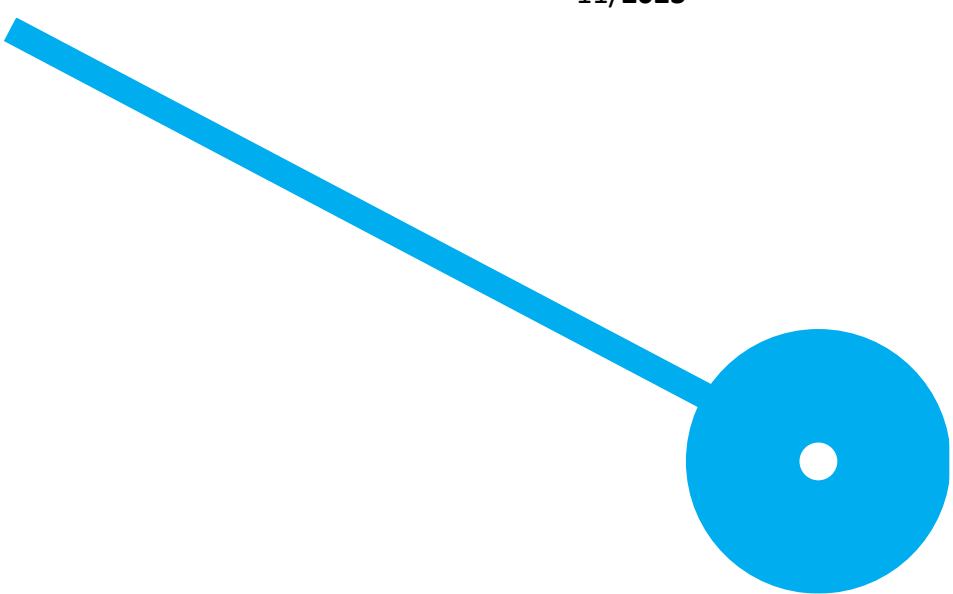
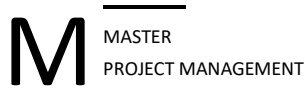


Which Project Management Knowledge Areas do SME's Managers value the most in Lourinhã municipality?

Jorge Miguel Santos Fernandes

11/2023





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Jorge Miguel Santos Fernandes

8160019

Advisor

PHD Vanda Lima

Dissertation submitted in fulfilment of the requirements for the Master's degree in Project Management in the School of Management and Technology of the Polytechnic of Porto.

Integrity Statement

I, Jorge Miguel Santos Fernandes, student nº 8160019, of the Master's Degree in Project Management of the School of Management and Technology of the Polytechnic of Porto, declare that I have not plagiarized or self-plagiarized, therefore the work entitled "Which Project Management Knowledge Areas do SME's Managers value the most in Lourinhã municipality?" is original and of my own authorship, not having been used previously for any other purpose. I further declare that all sources used are cited, in the text and in the final bibliography, according to the referencing rules adopted in the institution.

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Milestone are not only key moments for tracking progress, but also great opportunities to make retrospective, celebrate and spread gratitude about what was achieved.

Standing at this significant milestone in my academic journey, I would like to give a big word of gratitude to my family, teachers and my students, work colleagues, friends, those who collaborated with this dissertation and to all of those who build me and made me by any way who I am.

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Abstract

SMEs play a significant role in economic activity through employment, innovation, and growth, undertaking projects as an engine to survival and grow. However, project management standards cannot be fully applied in smaller companies, due to its characteristics. Smaller companies do not employ specialist project managers, and SMEs managers usually act as project managers. Therefore, due to unfamiliarity or resource constraints, managers may perform the processes they are most familiar with or that are easier to perform instead of those with a higher impact on project success.

To contribute to the development of SMEs, this study aims to understand the degree of knowledge, importance, and extent of use of each knowledge area by the SMEs managers to further define training guidelines for Lourinhã municipality. Systematic literature review was undertaken to build the theoretical background, along with quantitative research, based on the survey research strategy, for the empirical research. Data collection was carried out using an original online questionnaire, distributed to SME's from Lourinhã municipality. The sample comprised 62 companies. Descriptive and inferential statistical analysis were applied to data, using IBM SPSS software.

Results shown that few research was conducted on project management for SMEs. From the empirical research was perceived a nescience on project management. It was also noticeable that the knowledge areas which were better known, applied and perceived as important were learnt organically by running the business. The number of running projects shown to have the most positive correlation to the degree of knowledge, importance, and application of project management practices. Thus, in order to foster the understanding and application of project management practices would be of great value to: provide introductory training courses of project management fundamentals; and create a support infrastructure where SME managers could be prompt to drive projects, get advice and be guided on the best practices.

The small sample size and the use of a particular region, the municipality of Lourinhã, are the two main limitations of this study. This research provides relevant contributions to the field of project management, as well as to management practice at SME level.

Keywords: SMEs. Project management. Project manager. SME manager. Knowledge areas.

Resumo

As PME's têm um papel importante na economia através do emprego, inovação e crescimento, tendo a realização de projetos como um motor de sobrevivência e crescimento. No entanto, os standards de gestão de projetos não são totalmente aplicáveis em empresas desta dimensão. Empresas menores não empregam gestores de projetos especializados, atuando geralmente os gerentes como gestores de projetos. Consequentemente, devido à falta de conhecimento ou a limitações de recursos, os gestores realizam os processos com os quais estão mais familiarizados, ou que são mais fáceis de executar, em vez daqueles com maior impacto no sucesso do projeto.

Com o objetivo de contribuir para o desenvolvimento das PME's, este estudo visa compreender o grau de conhecimento, importância e utilização de cada área de conhecimento pelos gestores de PME's, a fim de definir diretrizes de formação para o município da Lourinhã. Foi realizada uma revisão sistemática da literatura para construir o enquadramento teórico juntamente com pesquisa quantitativa, tendo por base um questionário. A recolha de dados foi realizada através de um questionário online original, distribuído para as PME's do município de Lourinhã. A amostra foi composta por 62 empresas. Foram aplicadas análises estatísticas descritivas e inferenciais aos dados, utilizando o software IBM SPSS.

Os resultados mostraram que foram conduzidas poucas pesquisas sobre gestão de projetos para PME's, da mesma forma que a pesquisa empírica revelou uma falta de conhecimento sobre o tópico. Também foi perceptível que as áreas de conhecimento mais conhecidas, aplicadas e percebidas como importantes foram aprendidas organicamente através da gestão dos negócios. O número de projetos em andamento demonstrou a maior correlação positiva com o grau de conhecimento, importância e aplicação das práticas de gestão de projetos. Neste sentido, a fim de promover a compreensão e aplicação das práticas de gestão de projetos, seria de grande valor oferecer cursos introdutórios de gestão de projetos e criar uma infraestrutura de apoio que impulsionasse os gestores de PME's a criar projetos e os orientasse nas melhores práticas.

O reduzido tamanho da amostra e o uso de uma região específica, o município de Lourinhã, são as duas principais limitações deste estudo. Esta pesquisa oferece contribuições relevantes para o campo da gestão de projetos, bem como para a prática de gestão em nível de PME.

Palavras-chave: PME's. Gestão de Projetos. Gestor de Projetos. Gestor de PME. Áreas de Conhecimento.

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List of abbreviations

AFNOR	Association Française de Normalisation
AIRMIC	Association of Insurance and Risk Manager
APM	Association for Project Management
GDP	Gross domestic product
HR	Human Resources
IPMA	International Project Management Association
ISO	International Organization for Standardization
IT	Information Technology
KA	Knowledge Area
Mgt.	Management
OGC	Office of Government Commerce
P.	Project
PM	Project Management
PMBOK® Guide	Project Management Body of Knowledge
PMI	Project Management Institute
SD	Science Direct
SME	Small and medium-sized enterprise
TAK	Title, abstract and keywords
TSO	The Stationery Office
WoS	Web of Science

1. Introduction

It is widely recognized the importance of SMEs to the social and economic health of economies (Ayyagari et al., 2007; Beck & Levine, 2005), playing a significant part in economic activity through employment, innovation, and growth (Floyd & McManus, 2005).

According to European Commission SMEs generate 64.4% of employment, (*Eurostat*, 2021) and micro, small and medium-sized enterprises account for 99.8% of all companies in the European Union (Directorate-General for Enterprise and Industry et al., 2007; European Commission, 2008). According to Sabi (*Sabi*, 2023) 100% of Lourinhã municipality companies are micro, small and medium-sized enterprises and 63,85% of people employed in Lourinhã municipality are employed by SMEs, following the European Union metrics.

However, there is a tendency in the project management literature to focus on mega-projects (Brady & Davies, 2014; Eweje et al., 2012; Flyvbjerg, 2014; Winch, 2013), even though SMEs account for a substantial proportion of the projects that are undertaken. It has also been identified that project management is critical to the survival of small organizations (Marcelino-Sádaba et al., 2014). Studies further conclude that the project manager can contribute to project success by 34–47% (Toney, 2002), which can benefit the organizations with an improvement in productivity (McHugh and Hogan, 2011; Cleland, 1984), effectiveness (Shenhar et al., 2001), efficiency (Stimpson, 2008), and performance (Abbasi and Al-Mharmah, 2000).

In SMEs the manager takes a central role, as the small size of the firm implies a strong centralization of management (Torrès, 1999). Smaller companies do not employ specialist project managers and projects are managed by people with other primary roles, whose time and money for training is a constraint (Turner & Ledwith, 2018). Not only time but it also costs money to develop mature project management practices (Brettel et al., 2010; Masurel & van Montfort, 2006), and smaller companies are on average younger and not willing to make use of resources for that (Masurel & van Montfort, 2006; Rodney Turner et al., 2009). Along with the lack of specialists, most project management standards and frameworks developed to guide project management were primarily designed to manage large projects and cannot be fully applied to project management in SMEs (Marcelino-Sádaba et al., 2014). According to Zwikael (2009) PMI should identify the relative importance of each knowledge area, in order to better apply them in contexts of limited resources.

Some studies were conducted to sort KAs, by understanding the influence of each KA in the project success (Papke-Shields et al., 2010; Zwikael, 2009); the degree of degree of importance, adoption, and the perceived maturity of each KA (Abdul Rasid et al., 2014); and the relation between

extent of use and teaching priority of each KA (Nguyen et al., 2017). This studies presented KAs sorted by degree of practice, importance, extent, maturity and teaching priority, however they had limitation in what concerns to the geographical, specific industry and mainly by the fact that none was done for SMEs.

As a big gap still exists in research associating project management and SMEs scopes (Turner et al., 2012), and having project management such importance to SMEs, this research aims to understand how SME managers perceive project management practices, and to understand and provide a guidance on how to provide them with tools and techniques to use project management to foster company's development. The main objective of study is to identify the degree of knowledge, importance, and extent of use given by SME managers in Lourinhã municipality to each of the ten Knowledge Areas from PMBOK® Guide fifth edition. The specific objectives are as follow:

1. Appoint which project management knowledge areas SME managers have better knowledge in and in which they lack knowledge the most;
2. Appoint which project management knowledge areas SME managers consider more and which they consider less relevant;
3. Perceive the application degree of each project management knowledge area by SME managers;
4. Define training guidelines for the local community of SMEs.

For this research bibliometric and systematic literature review was carried out to understand the state-of-art and better understand the research gap. Empirical research was conducted on Lourinhã municipality with a questionnaire survey. Data was further analyzed using descriptive and inferential statistical analysis.

This document is divided in six chapters: 1. Introduction: aims to present the dissertation's theme and relevance, the main and specific objectives, and introduce the structure of this document; 2. Literature review: presents the relevant introductory concepts and the state-of-art research on the topic under study; 3. Methodological approach : Presents the research method and objectives, the bibliometric and systematic literature review, the research approach, and the context of the study; 4. Results presents the variables used for the study, along with analysis of the results from the questionnaire survey including the sorting of the knowledge areas, multiple linear regression models and comparisons of means of results for small and medium-sized enterprises; 5. Conclusions presents the main conclusions and limitations of the study, amongst future research that may derive from the one conducted; and at last 6. Reference List with the reference to the sources used for this research.

2. Literature review

2.1. SME concept

Several definitions of SME arise while making a literature review, acceptable by the fact that there is no consistent definition of SME (Mcadam et al., 2004).

A study on the Senegalese context conducted by Sane (2020) defines SME “as any legal or natural person producing goods or market services having between 1 and 250 employees and achieving a turnover annual duty free less than 15bn CFA francs”.

Another study, held in UK by (Jayawickrama, Liu, Smith, et al., 2019) follows the definition provided by Schoenherr et al. (2010) stating that SMEs are companies “with between 0 and 249 employees, and an annual turnover not exceeding €50 million”. As a result, 99% of businesses in the UK and European Union are considered SMEs by this definition.

However, another definition of SME established by European Commission (Directorate-General for Enterprise and Industry et al., 2007; European Commission, 2008) can be found, setting the following criteria to classify companies by size (Table 1):

Table 1. Thresholds to classify companies by size.

SME thresholds	Staff	Turnover	Balance sheet
Micro enterprise	<10	<2 MEuros	<2 MEuros
Small Enterprise	<50	<10 MEuros	<10 MEuros
Medium-sized Enterprise	<250	<50 MEuros	<43 MEuros

* Source: (European Commission, 2008)

As pointed by Marcelino-Sádaba et al. (2014), it is important to note that:

“Even though it is obligatory to respect the thresholds referred to computing staff, an SME may choose to meet either the turnover limit criterion or the balance sheet; it does not have to meet both and can exceed one of the two and still be considered an SME”.

Considering the above, this study will only consider the primary measure of size defined by European Commission, the number of employees, to discriminate SMEs as the companies database used in this study does not provide reliable turnover and balance sheet data.

2.2. SMEs importance to economy

The importance of small to medium enterprises to the social and economic health of economies around the globe has been widely recognized and researched for some time (Ayyagari et al., 2007; T. Beck & Levine, 2005). SMEs play a significant part in economic activity through employment, innovation, and growth (Floyd & McManus, 2005). As defended by Murphy & Ledwith (2007), “ranging from the dynamic, innovative, and growth-oriented to the traditional enterprises satisfied to remain static, SMEs are critical to the economy as an engine of economic and social development”.

According to European Commission (2008), SMEs represent an especially important part of the European economy, not only as a major source of jobs, but also by creating entrepreneurial spirit, innovation and, therefore, being essential to promote competitiveness and employment. Considering the European Commission's metrics (Table 1), SMEs generate 64.4% of employment in the European Union, employing over 100.5 million people (Eurostat, 2011).

As disclosed in the European competitiveness reports (Directorate-General for Enterprise and Industry et al., 2007; European Commission, 2008), SMEs, including micro-sized companies, account for 99.8% of all companies in the European Union, generating 56% of GDP and employing 70% of private sector workers.

On a more project-related outline, (Turner et al., 2009) showed that projects account on average for one third of the turnover of SMEs, and thus projects in SMEs account for almost one fifth of the economy. This is more than is spent on large infrastructure projects in the Western economies (The World Bank, 2006; Turner, Huemann, et al., 2010), and yet large infrastructure projects receive far more attention (Hertogh et al., 2008), a thematic that will be address later.

As this study will have its focus on Lourinhã municipality, it is important to show its business community is similar to what have been presented before. In the following tables (Table 2, Table 3 and Table 4) is visible that Portugal and Lourinhã follows the European Union percentages of SMEs and that Lourinhã follows also the European Union metric of people employed by SMEs. This will ease comparison of the results form the empirical research with the results from the literature review.

Table 2. Portuguese active companies by size.

	Number of companies	Percentage
Total	407929	100,00%
< 10 employees	357726	87,69%
< 50 employees	41886	10,27%
< 250 employees	7071	1,73%
≥ 250 employees	1168	0,29%

* Source: (Sabi, 2023)

Table 3. Lourinhã municipality's active companies by size.

	Number of companies	Percentage
Total	1042	100,00%
< 10 employees	903	86,66%
< 50 employees	122	11,71%
< 250 employees	16	1,54%
≥ 250 employees	1	0,10%

* Source: (Sabi, 2023)

Table 4. Number of employees by company size in Lourinhã municipality.

	Number of employees	Percentage	N.a. values
Total	6421	100,00%	165 companies
< 10 employees	2321	36,15%	156 companies
< 50 employees	2108	32,83%	7 companies
< 250 employees	1605	25,00%	2 companies
≥ 250 employees	387	6,03%	0 companies

* Source: (Sabi, 2023)

2.3. Project management main concepts

Many institutions, standards, and frameworks such as International Project Management Association (IPMA, 2006); Office of Government Commerce (OGC, 2007); Project Management Institute (PMI, 2013), and International Organization for Standardization (ISO, 2012) support project management in practice. Naturally, various definitions linked to project management thematic emerge from those different entities, such as the definition of project, project management, knowledge areas or areas of knowledge.

It is the responsibility of the organization undertaking the project to select the most appropriate standards and guides to follow, being ISO 21500:2012 (ISO, 2012) and PMBOK® Guide (PMI, 2013) some of the most influential publications (Morris & Geraldi, 2011).

According to Nguyen et al. (2017) PMBOK® Guide is considered the most popular body of knowledge worldwide. Therefore, the body of knowledge from PMI (2021, p. 4) was consulted to define project, project management and project manager, stating the following:

“Project. A temporary endeavor undertaken to create a unique product, service, or result. The temporary nature of projects indicates a beginning and an end to the project work or a phase of the project work. Projects can stand alone or be part of a program or portfolio.”

“Project Management. The application of knowledge, skills, tools, and techniques to project activities to meet project requirements. Project management refers to guiding the project work to deliver the intended outcomes. Project teams can achieve the outcomes using a broad range of approaches (e.g., predictive, hybrid, and adaptive).”

“Project Manager. The person assigned by the performing organization to lead the project team that is responsible for achieving the project objectives. Project managers perform a variety of functions, such as facilitating the project team work to achieve the outcomes and managing the processes to deliver intended outcomes.”

After examining the previous definitions, it is notorious the key role of the project manager for the project success, as the responsible person to bring together all project resources and achieve the objectives. This is confirmed by a previous study which states that the project manager can contribute to project success by 34–47% (Toney, 2002). However, this cannot be achieved without standards and proper training, which can benefit the organizations with an improvement in productivity (McHugh and Hogan, 2011; Cleland, 1984), effectiveness (Shenhar et al., 2001), efficiency (Stimpson, 2008), and performance (Abbasi and Al-Mharmah, 2000).

Many standards have been developed throughout the world with the pursuit to codify what has been observed in the on-going research and practice (Cicmil & Hodgson, 2006). Such standards have been developed and published by many organizations, such as the ones enumerated in the beginning of this section, with the purpose to increase project success rates. As referred by Papke-Shields et al. (2010), “the spread of these standards demonstrates evidence of worldwide growth in awareness and acceptance of the need for formal PM methods”. However, to enable project management to grow in maturity within practitioners and organizations, education programs are required to foster appropriate implementation of the standards.

Mature organizations should be able to manage projects effectively, being capable of delivering the requisite outcomes consistently, efficiently, and effectively (Cooke-Davies, 2004), benefiting from

lower costs and a shortened development times after applying a relevant project management system (Kerzner, 2013).

A survey by PricewaterhouseCoopers (2007) revealed that the greater the project management maturity, the greater the impact on overall project performance can be, assessing also that well developed people management skills are fundamental to a high project management maturity level.

Confirming what have been written about the recognition of PMI as a reference, scholars also refer that most project management education programs focus on PMBOK® Guide -based subjects (Pant & Baroudi, 2008; Thomas & Mengel, 2008).

PMBOK® Guide presents a series of processes and knowledge areas accepted as best practice in project management (PMI, 2013). It is distinguished as an international standard that can be applied in various industries, having previous studies shown that application of the nine knowledge areas of project management presented by PMI on its PMBOK® Guide 4th Edition (PMI, 2008) are essential for project success (Rasid et al., 2014).

Although the project management field has a vast number of research areas that are being addressed by leading research institutions, it has long been considered a close to practice discipline (Söderlund & Maylor, 2012). This concludes that academic offerings in Project Management education programs need to be closely aligned with professional industry practices (Alam et al., 2008; Ashleigh et al., 2012).

These evidences leads to the need of studying the degree of knowledge, importance, and extent of use of each knowledge area by the SMEs managers in Lourinhã municipality, in order to come up with training guidelines for this population.

2.4. SME manager and project manager profiles

2.4.1. Project manager profile

The project management definition according to PMI (2021) was already written before, however, in order to better understand the profile and skillset required to hold the profession, the definition of project management according to PRINCE2 (TSO, 2017, p. 9) will also be presented, as follow: "Project management is the planning, delegating, monitoring and control of all aspects of the project, and the motivation of those involved, to achieve the project objectives within the expected performance targets for time, cost, quality, scope, benefits and risk."

PMI (2013, p. 16) also figure up that project manager's role is distinct from a functional manager or operations manager, being the functional manager focused on providing management oversight for a functional or a business unit, and the operations manager responsible for ensuring business operations efficiency. According to the definitions of project management and project manager, we can conclude that he plays a much more integrative role within the project than the functional or operations managers.

Project manager's responsibilities and competences, according to PMI (2013, p. 17) are satisfying the task needs, team needs, and individual needs, being the link between the strategy and the team. Thus, the project manager must not only understand and apply the knowledge, tools, and techniques that are recognized as good practice for effective project management, along with any area-specific skills and general management proficiencies required for the project, but also possess knowledge, performance, and personal competences for effective project management.

In the role of people manager, as the responsible person to manage the project team and the other stakeholders, PMI (2013) also approaches interpersonal skills as a part of a project manager profile. According to PMBOK® Guide (PMI, 2013, pp. 17-18) the profession requires "a balance of ethical, interpersonal, and conceptual skills that help the project manager analyzing situations and interacting appropriately", such as: leadership; team building; motivation; communication; influencing; decision making; political and cultural awareness; negotiation; trust building; conflict management; and coaching.

On other point of view, PRINCE2 (TSO, 2017, p. 10) gives a special role to the planning and delegating capabilities of a project manager, pointing the importance of the ability to delegate in any form of management but particularly in project management. This is justified by the cross-functionality and risks involved in projects. The project manager is thus presented by PRINCE2 as someone responsible for implementing the cycle of planning, delegating, monitoring, and controlling, taking the necessary measures to keep the project going according to plan, or changing the plan if required or if an opportunity is perceived.

Even though PMI gives a much more detailed project manager definition, required skills and scope of work, PRINCE2 looks to have the most relevant definition for this study. This naturally comes from the fact that PMBOK® Guide was created to guide the management of big projects and PRINCE2 tailored for smaller ones, as will be addressed further. Thus, the information presented in PRINCE2 regarding the person of the project manager looks to be much more aligned with what is needed to compare with the SME manager profile.

2.4.2. SME manager profile

The scientific literature regarding SME manager's profile is scarce and this topic is mainly published in conference proceedings. However, these documents will have to be used in this section as it is the only information available.

To better understand the profile of a SME manager, it is important to refer that researchers tend to agree that SMEs are not reduced models of big firms (Alami & Koubaa, 2018). They are a mega-person compared to large enterprises which are a mega-structure. In SMEs the manager takes a central role, due to the small size of the firm which implies a strong centralization of management (Torrès, 1999). This gives the SME a personal character, in a way that SMEs issues cannot be approached without approaching those of its manager (Faber, 2000).

Regarding the importance of the manager to the SME, Alami & Koubaa (2018) made a significant contribution:

"The manager is the key person in SME; he is most often the owner of the organization, he acts as a strategist and makes decisions through his various personal and professional characteristics that are reflected in the day-to-day management of his business, so he is the one who bears all the risks and uncertainties in the business.

Indeed, the SME manager perceives the company as an extension of his personality which gives him the tone of an entrepreneur."

As the profile of the SME manager is still not defined, a study by Velegrakis et al. (2010) tried to define it from the point of view of the required competences to undertake the job. SMEs economic context is inherently unstable, driven by the economic cycles, thus companies, in the head of the manager, must act and adapt in a dynamic way. This way, the manager must combine a diversified set of competences to lead the company towards the right direction (Velegrakis et al., 2010). The authors divide those competences into 4 categories: personal, technical non-financial; business & financial; and leadership.

The results from the study (Velegrakis et al., 2010) resulted in the following competences set (Table 5):

Table 5. SME manager set of competences by category.

Category	Competence
Personal	Ç Attitude towards uncertainty and risk
	Ç Innovative spirit
	Ç Fulfilment of tasks and goals
	Ç Self-confidence
	Ç Communication skills
	Ç Ability to discover new opportunities
	Ç Conceptual ability
Team management	Ç Negotiation and decision-making
	Ç Time management for own work and the team's work
	Ç Communication to the team of clear expectations of performance
	Ç Regular supply of feedback to the team on its performance
	Ç Full use of the capacities and knowledge of the team
	Ç Promote mutual confidence
	Ç Develop autonomy of a group
	Ç Raise awareness of collective responsibility
	Ç Ability to build and lead a team (leadership spirit)
Technical non finance	Ç Ability for project management
	Ç Ability to create and provide strategic/tactical/operational plans
	Ç Management of human resources from an organizational perspective (allocation/attribution of tasks)
	Ç Management of other resources (non-human)
	Ç Awareness of corporate social responsibility
	Ç Knowledge of the administrative/bureaucratic process for founding a company
	Ç Knowledge of the legal requirements for business
Business & Finance	Ç Knowledge of the most important legal forms of business ownership
	Ç Process analysis and change management
	Ç Knowledge of general business conditions and functions
	Ç Knowledge of what to think about when deciding whether to found a business or not
	Ç Knowledge of foreign trade and international trade relations
	Ç Distinguish the financial issues between different company sectors (manufacturing/services)
	Ç Management of the different performance functions within an enterprise
	Ç Understanding of different forms of financing (self-financing, external financing)
	Ç Basic sales-planning skills
	Ç Knowledge of accountancy and taxes
	Ç Ability to plan and control: direct costs, overhead costs, cost prices, gross and net sales price, and earnings/profits

* Source: (Velegakis et al., 2010)

On the sequence of the study by Velegakis et al. (2010) another one was held by Dominguez et al. (2010) to sort the competences by relevance. The main conclusions from Dominguez et al. (2010) were as follow:

- From the top four competences, three are related to personal characteristics of managers (innovative spirit, fulfillment of tasks and goals and communication skills) and one with team management (negotiation and decision-making abilities);

- A second set of “less” important but still particularly important competences are related to business and finance (ability to plan and control costs), to personal characteristics (ability to discover new opportunities and self-confidence) and to team management (ability to build and lead a team);
- All the personal characteristics are considered of great importance, with five of them being at the first seven positions of the ranking;
- The importance of planning and controlling costs was on the fifth position, justifiable by the context of increasing market pressure due to competitiveness.

From this study can be deducted the importance of the personal and team management competences of the SME Manager, along with the ability to plan and control costs. This is justifiable by the fact that in a very dynamic economic context, the SME manager needs to be able to generate innovative responses, decide to implement them in an adequate timeframe, communicate/ negotiate them to all stakeholders, implement the necessary changes and put them in practice to challenge competitors and seduce customers (Dominguez et al., 2010).

2.5. Project management on SMEs

2.5.1. Project management for mega-projects

As said by R. Turner et al. (2012), a large place to explore exists in the research on Project Management within SMEs scope.

There is a tendency in the project management literature to focus on mega-projects (Brady & Davies, 2014; Eweje et al., 2012; Flyvbjerg, 2014; Winch, 2013). This is understandable, given the proportions of their failures and successes, and the large sums invested. However, the even major importance of SMEs to the social and economic health of countries has long been recognized (Ayyagari et al., 2007; Beck & Levine, 2005).

According to Hertogh et al. (2010) “project management had its genesis in the management of large engineering and construction projects, and subsequently procedures such as PRINCE2 have been developed for medium-sized projects, but very little is written about the management of the smallest of the projects”. The authors also refer that project management procedures for medium-sized projects have been developed (Andersen et al., 2009; TSO, 2017; Turner, 2009), with a much greater focus on people as social animals, however, they are also too bureaucratic for small projects, though much more tailorable.

Various standards have also been developed to help project managers (AFNOR, 2003; AIRMIC et al., 2002; APM, 2004; ISO, 2012; OGC, 2007; PMI, 2013; TSO, 2017), which set out rules and guidelines to achieve, through repeated use, maximum success of the objectives (Escribá-Esteve et al., 2009). However, according Marcelino-Sádaba et al. (2014) “most of the cited project management standards were primarily designed to manage large projects and cannot be fully applied to project management in SMEs”.

As examples of the above, from the standards cited three address risk thematic (AFNOR, 2003; AIRMIC et al., 2002; APM, 2004) and one addresses specifically program management (OGC, 2007), thus not being tailored for SMEs which require more general guidelines on project management and run no programs. As already addressed, PMBOK® guide (PMI, 2013) was created to guide the management of big projects also not being suitable for companies of smaller scale due to its complexity. ISO (ISO, 2012) states to provide “guidance for project management and can be used by any type of organization, including public, private or community organizations, and for any type of project, irrespective of complexity, size or duration”. However, on its new version (ISO, 2021) it specifies not only the context and concepts for undertaking project, but also for program and portfolio management, making it harder to understand and use by SMEs. From the cited standards, only Prince2 (TSO, 2017) shown to be developed for medium-sized projects, as stated by Hertogh et al. (2010).

On a practical level, the management community in general and the project management community in particular do little to provide SMEs with guidance on managing projects (Diab, 2011). Researchers have investigated factors contributing to the performance of SMEs, but work has focused mainly on the contribution of the management team (Escribá-Esteve et al., 2009) and the founding entrepreneur (Blackburn & Kovalainen, 2009), not in the process of project management itself.

Therefore, it is expectable that the nature of project management required by SMEs is different from the traditional forms of project management developed for larger projects (IPMA, 2006; Kerzner, 2013; PMI, 2013; TSO, 2017; J. R. Turner, 2007; R. Turner, 2009; R. Turner, Ledwith, et al., 2010) both because the nature of SMEs is different from larger organizations, and because in general they are undertaking smaller projects.

2.5.2. Importance of the projects to SMEs

As written before, mega-projects may be more dramatic, but they remain the minority of projects executed compared with those undertaken by much smaller organizations. SMEs account for a substantial proportion of the projects that are undertaken and has also been identified that project management is critical to the survival of small organizations (Marcelino-Sádaba et al., 2014).

Turner et al. (2009) found that in Europe a third of the turnover of SMEs is project-based. Surprisingly, however, little research has focused on the ways in which project management is used in SMEs (Pollack & Adler, 2016), although some work has been done within project-based industries (Masurel & Van Montfort, 2006).

Smaller firms on average do smaller projects than larger ones. Accordingly, there is a need to adopt project management procedures appropriate to the size of project they do (Payne & Turner, 1999). Smaller firms also have fewer layers of management and working practices focused more on people than on processes (Ghobadian & Galleary, 1997).

Turner & Ledwith (2018) presented a table (Table 6) summarizing the organizational and team structures by size of company.

Table 6. Organizational and team structures by size of company.

Firm size	Number of people	Number of business units	Levels of Management	Nature of work	Nature of processes
Micro	Less than 15-20	One	One - Entrepreneur	Multitasking	People focused
Small	Less than 45-50	Several	Two - Board - Team Leaders	Multitasking	People focused
Medium	More than 45-50	Several	Three - Board - Managers - Team leaders	Specialists	Formal

* Source: (Turner & Ledwith, 2018)

As have been noticed, the substantial differences between small and large companies makes project management methodologies not applicable in all cases. SME projects, in general, tend to meet one or more of the following characteristics (Turner et al., 2009):

- They are small;
- They are internal;
- Objectives are concretely defined;
- Team size is very small;
- They are concurrent with the company's daily activities.

This are specifications that must be taken in consideration when using a project management methodology.

Ledwith (2004) and Murphy & Ledwith (2007) also conducted initial investigations into Project Management practices in SMEs in high-tech and service industries in Ireland. They identified that SMEs should follow a structured process for selecting their project management practices, by identifying:

- ¸ Their strategic objectives;
- ¸ Appropriate success criteria and key performance indicators for their projects;
- ¸ And thus appropriate success factors;
- ¸ And thus appropriate project management tools and techniques, which meet the criteria outlined above.

However, to be able to choose a standard that fits the characteristics of SME companies, knowing them and following a structured process for selecting project management practices is not enough. The community of researchers and practitioners must work to define appropriate guidelines for SME projects.

2.5.3. Benefits from applying project management on SMEs

Even though still little research was conducted about project management on SMEs, some important points were confirmed about the benefits of applying it in this particular scope.

A study by Pollack & Adler (2016) indicated that project management skills were shown to have the strongest positive correlation to total sales, while compared with IT professional and support skills, financial skills, and business skills. Business that used project management reported sales figures that where on average three times higher than those who did not.

On another study from the same author (Pollack & Adler, 2014) project management was also found to have a greater impact on productivity, while compared with marketing skills or business management skills, suggesting that organizations interested in increasing their productivity should invest in project management skills over these other disciplines. The authors also adds that firms with smaller revenues tend to spend a greater percentage of their revenue on marketing, on a higher percentage than they spend on project management, the authors suspects. As a conclusion, they suggest an increase of investment in project management over other disciplines, to increase productivity and sales.

2.5.4. Need of a simplified project management version

Turner et al. (2010, 2012) showed European SMEs need to adopt more informal, less bureaucratic, more people focused project management practices than those adopted by larger organizations on larger projects. SMEs will perhaps use a different toolset to traditional versions designed for medium or large projects. They need different versions depending on the size of the project (medium, small, or micro) (Turner, Ledwith, et al., 2010).

What was written is in consensus to Perren & Grant (2000) who say informal management and leadership practices are the most effective in emergent businesses, rising the need for greater formality as the firm grows. It is also important to keep in mind that it takes time to develop more formal practices (Brettel et al., 2010; Masurel & Van Montfort, 2006), being a natural process of healthy company growth. Also a study by Hertogh et al. (2010) defends that project management methodologies still do not fit SMEs. Even though, according to the author, procedures such as PRINCE2 (TSO, 2017) have been developed for SMEs, they are too bureaucratic and provide too formalistic structures for SMEs needs.

Another topic to consider is that smaller companies do not employ specialist project managers and projects are managed by people with other primary roles, whose time for training is a constraint (R. Turner & Ledwith, 2018). It doesn't only take time, but it also costs money to develop more mature practices (Brettel et al., 2010; Masurel & Van Montfort, 2006), and smaller companies are on average younger and not willing to make use of resources for that (Masurel & Van Montfort, 2006; Turner et al., 2009).

Turner (2009) also pointed that small and micro-sized companies do not tend to use the recognized tools and techniques of project management, concluding that a simplified project planning and control system, with simplified reporting systems is expected.

In the study by Hertogh et al. (2010) most of SMEs surveyed said they needed a simplified version of project management, because traditional project management is too bureaucratic. The conclusion was that usually medium sized companies need a "lite" version of Project management and small and micro companies need a "micro-lite" version.

Most research into improving the performance of SMEs has tended to be focused on entrepreneurship and innovation with the management of project-related activities submerged in general business discussions around sales and marketing, accounts, human resource management, and information technology (Hudson et al., 2001; Turner et al., 2009; Turner, Ledwith, et al., 2010). Nonetheless, project management has been identified as a valuable skill for SMEs (Turner et al., 2012)

which needs to be studied to propone simpler project management approaches and ways to tailor them to the company and project-specific need.

The importance of project management to SMEs needs also to be addressed and widespread in a deeper way for the benefit of economy.

2.6. Project management knowledge areas

In its most recent version PMBOK® Guide (PMI, 2021) deprecated the use of knowledge areas, introducing the concept of performance domains as “a group of related activities that are critical for the effective delivery of project outcomes. Project performance domains are interactive, interrelated, and interdependent areas of focus that work in unison to achieve desired project outcomes.” PMBOK® Guide 7^h edition presented eight project performance domains, namely: Stakeholders; Team; Development Approach and Life Cycle; Planning; Project Work; Delivery; Measurement; and Uncertainty.

Despite the fact that PMI has put into disuse the concept of Knowledge area to introduce the performance domains, in order to find relevant studies to conduct a literature review the 10 knowledge areas presented in PMBOK® Guide on previous editions will be used. This will not only allow to find previous studies regarding this topic, but also enable to compare the results of the empirical research to be held with the results from the academy,

Few research has been conducted with the objective to sort the project management knowledge areas according to its importance to project success, its degree of practice, maturity, or to the teaching priority given by educational institutions.

Being an objective of this research to conclude until which intent each of the ten knowledge areas from PMBOK® Guide is known, perceived as relevant and used by managers in Lourinhã's SMEs, a summary of what have been studied will be conducted.

In its research, Zwikael (2009) referent:

“Project managers often have limited time to perform all that is required by the PMBOK® Guide. Therefore, project managers may choose to perform those processes that they are most familiar with or that are easier. In doing so, they may give lower priority to knowledge areas that have higher impact on project success.

He also concludes that PMBOK® Guide itself should identify the relative importance of each knowledge area. However not many efforts where done on this direction as will be addressed.

Both PMBOK® Guide 5th edition (PMI, 2013) and ISO 21500:2012 (ISO, 2012) groups the project management processes in knowledge areas or subjects. A summary from the study from Varajão et al. (2017) compared both, being presented below the knowledge areas from PMBOK® Guide, named as subjects on ISO 21500:2012 (Table 7).

Table 7. PMBOK® Guide 5 Knowledge Areas and ISO 21500:2012 Subjects.

PMBOK® Guide 5 Knowledge Areas	ISO 21500:2012 Subjects
Integration	Integration
Stakeholder	Stakeholder
Scope	Scope
Human resources	Resource
Time	Time
Cost	Cost
Risk	Risk
Quality	Quality
Procurement	Procurement
Communication	Communication

* Source: Own authorship

It is noticeable the alignment of ISO 21500:2012 (ISO, 2012) and PMBOK® Guide (PMI, 2013). There are only two divergences: PMBOK® Guide divides the processes by knowledge areas, called subjects by ISO; and the Human resources knowledge has a correspondent subject from ISO called Resources.

In the sequence of what have been written, the nomenclature proposed by PMBOK® Guide (PMI, 2013) was chosen for this study, since the processes of ISO 21500:2012 and PMBOK® Guide are similar, and PMBOK® Guide has a more detailed list of processes, tools, and techniques (Varajão et al., 2017). In addition, several other studies also opted to use practices based on PMBOK® Guide (Ling et al., 2009), making it easier to compare results by using the knowledge areas.

With the intent to define the concept of knowledge area, the main substance of what was written about it in PMBOK® Guide (PMI, 2013, p. 60) is as follow:

“A knowledge area represents a complete set of concepts, terms, and activities that make up a professional field, project management field, or area of specialization. These ten knowledge areas are used on most projects most of the time. Project teams should utilize these ten knowledge areas and other knowledge areas, as appropriate, for their specific project.”

On its Fourth version, PMBOK® Guide identifies only nine knowledge areas (PMI, 2008). Project Stakeholder Management was added on its fifth version (PMI, 2013), so on some of the studies presented in this section nine knowledge areas might be presented instead of ten.

As a first attempt to sort knowledge areas by importance, the well-known triple constraint or “iron triangle” must be referenced: time, budget, and scope (Atkinson, 1999). Those reflect the traditional core goals of managing projects. Other researchers also focus on the “quadruple constraint”, which includes quality along the “iron triangle” (Schwalbe, 2012). The PMBOK® Guide fifth edition suggests these four constraints plus risk and resources as the main ones, but states that there may be others as well, depending on the project (PMI, 2013).

Knowledge areas have been compared in a limited number of studies. A study by Ibbs & Kwak (2000) found that project managers pay most attention to cost and communications areas. Cooke-Davies (2002) argues that risk and human resources knowledge areas are critical for project success. Time management is also considered by many scholars to be the basis for project management (Demeulemeester & Herroelen, 2002; Y-T Leung & Anderson, 2004). Human resources and risk knowledge areas, which are considered to be critical project management factors by Cooke-Davies (2002), have also been found to be the knowledge areas with the most influence on project performance.

The divergence of results shown above can be justified by previous studies finding that high differences exist among various industries (Müller & Turner, 2007a, 2001, 2007b) and/ or regions (Nguyen et al., 2017). No study to sort project management knowledge areas by importance was found for SMEs; however, four studies held since 2012 were found under the general domain, which will be presented along with its conclusions (Table 8). Underlined are shown the main limitations of the studies. Bellow in this chapter, each will be presented in more depth.

Table 8. Summary of studies about knowledge areas importance.

Study	Topic	Main results
(Papke-Shields et al., 2010)	How project management practices are linked to project success, <u>assessed by 142 project managers on a regional chapter of the PMI in the eastern United States.</u>	- Matrix relating significant project management practices to project success; - KAs sorted by degree of practice; - Provide support for the link between the use of project management practices and increased project success.
(Zwikaël, 2009)	What is the importance of each KA by calculating the impact of their related <u>planning processes</u> to the project success	- KAs sorted by extent of use and importance to project success; - KAs importance and extent of use are not always aligned; - Training companies may need to rethink the proportion of each KA in the course curriculums.
(Abdul Rasid et al., 2014)	Determine the degree of importance, adoption, and the perceived maturity of each KA on <u>a public agency in Malaysia</u>	- KAs sorted by importance, adoption and perceived maturity; - Adoption of the nine KAs of project management is crucial for project success; - Increasing the level of maturity can ultimately lead to greater project delivery success.
(Nguyen et al., 2017)	Studies the relation between extent of use and teaching priority of each KA, <u>limited by its small sample size (21% of 256 programs)</u>	- KAs sorted by extent of use and teaching priority for Europe and North America separately. - Findings can serve as the basis for educators to develop, review, or revise their program curricula and serve as a point of departure in discussing with industry practitioners in soliciting their needs.

2.6.1. Extent of use and importance of each knowledge area

A study by Papke-Shields et al. (2010) assessed how the use of project management practices are linked to project success. The degree of practice was accessed by knowledge area, process group and individual frequency of use and a matrix between individual project management practices and success dimensions was developed.

Some of the conclusions were that risk management practices are applied less, which is not surprising given that risk management is “frequently over-looked” (Schwalbe, 2012), perhaps in part because project managers may tend to avoid thinking about what could go wrong in a project. This study also provided additional support for the link between the use of project management practices and increased project success, corroborating with the previous observation done by Zwikaël & Globerson (2004). The knowledge areas sorted by degree of practice are shown in Table 9.

Another study, from Zwikaël (2009), had its focus on the processes of planning phase, as they represent 47% of all processes and are considered a critical phase in any project (Cooper &

Kleinschmidt, 1995; Fortune & White, 2006; Pinto & Slevin, 1987). His article analyzed the relative importance of each knowledge areas by calculating the impact of their related planning processes to the project success. The author presented the results for the complete sample and by industry. For this study, the results for the entire sample will be presented.

Some of the conclusions taken in the study of Zwikael (2009) were that the project planning knowledge areas that most influence project success results are time, risk, scope, and human resources. The knowledge areas that have the lowest impact on project success are cost and procurement. By analyzing the extent of use of each knowledge area, was visible that knowledge areas importance and extent of use are not always aligned, as communications and quality knowledge areas are usually underworked.

In his research Zwikael (2009), also noted that project management training companies may need to rethink the proportion of each knowledge area in their project management course curriculums.

A summary of the sorted knowledge areas from the study of Zwikael (2009) is also shown in Table 9. The different results from the outcomes of the degree of practice from Papke-Shields et al. (2010) and the extent of use from Zwikael (2009) studies might be justified by the different regions under study (Nguyen et al., 2017) or because Zwikael (2009) studied only the planning process. The importance to project success is also presented in Table 9, as it is one of the outcomes from Zwikael (2009) research.

Table 9. Main findings from Papke-Shields et al. (2010) and Zwikael (2009).

	Degree of practice *	Extent of use **	Importance to Project Success **
P. Integration Mgt.	4 th	1 st	5 th
P. Scope Mgt.	2 nd	3 rd	3 rd
P. Time Mgt.	1 st	2 nd	1 st
P. Cost Mgt.	3 rd	5 th	8 th
P. Quality Mgt.	8 th	7 th	6 th
P. HR Mgt.	5 th	4 th	4 th
P. Communications Mgt.	7 th	8 th	7 th
P. Risk Mgt.	9 th	6 th	2 nd
P. Procurement Mgt.	6 th	9 th	9 th
P. Stakeholder Mgt.	Not studied	Not studied	Not studied

* Source: (Papke-Shields et al., 2010)

** Source: (Zwikael, 2009)

2.6.2. Perceived maturity of each knowledge area

Abdul Rasid et al. (2014) conducted a similar study, with the objective to determine the degree to which project management knowledge areas have been adopted by one public agency and to assess the current maturity level of project management as perceived by project managers.

This study differs from the previous ones by being relative to a single public agency and by introducing the concept of maturity. As a result, knowledge areas were sorted by importance, degree of adoption and perceived maturity (Table 10).

Kerzner (2013) described project management maturity as the development of processes and systems that are repetitive and provide a high likelihood of project success. The project management maturity model developed by Crawford (2010) divided project management maturity into five levels. These five levels were used in the study and are: level 1: initial process; level 2: structured process and standards; level 3: organizational standards and institutionalized process; level 4: managed process; and level 5: optimizing process.

It adds interest that this study introduces the concept of maturity, however it will not be directly comparable with the results of empirical research as maturity will not be assessed. Regarding the results from the study of Abdul Rasid et al. (2014), they are hardly comparable with other studies, since they refer to a single specific public agency.

Table 10. Main findings from Abdul Rasid et al. (2014).

	Importance *	Adoption *	Perceived Maturity *
P. Integration Mgt.	3 rd	3 rd	3
P. Scope Mgt.	1 st	2 nd	3
P. Time Mgt.	2 nd	7 th	3
P. Cost Mgt.	2 nd	5 th	3
P. Quality Mgt.	2 nd	1 st	4
P. HR Mgt.	4 th	8 th	2
P. Communications Mgt.	4 th	4 th	3
P. Risk Mgt.	6 th	9 th	3
P. Procurement Mgt.	5 th	5 th	2
P. Stakeholder Mgt.	Not studied	Not studied	Not studied

* Source: (Abdul Rasid et al., 2014)

2.6.3. Teaching priority of each knowledge area

As referred by Zwikael (2009), training companies may need to rethink the proportion of each knowledge area in their project management course curriculums.

The study undertaken by Nguyen et al. (2017) seeks to study the relation between extent of use and teaching priority of each knowledge area of project management.

As written before in chapter 2.3, other authors (Alam et al., 2008; Ashleigh et al., 2012) refers that the project management field has long been considered a close to practice discipline (Söderlund & Maylor, 2012), stating that education programs need to be closely aligned with professional industry practices (Alam et al., 2008; Ashleigh et al., 2012).

In his work, Nguyen et al. (2017) aims to investigate how different project management knowledge areas are currently delivered in the project management degree programs around the world and verify if the level of teaching emphasis for the project management knowledge areas are aligned with their perceived extent of use in practice.

The results shown were presented by the author for Europe and North America separately. As extent of use and teaching priority are influenced by region, in this document will be shown only the results from Europe (Table 11).

Table 11. Main findings from Nguyen et al. (2017)

	Extent of use *	Teaching priority *
P. Integration Mgt.	9 th	9 th
P. Scope Mgt.	3 rd	8 th
P. Time Mgt.	1 st	2 nd
P. Cost Mgt.	1 st	3 rd
P. Quality Mgt.	8 th	10 th
P. HR Mgt.	10 th	6 th
P. Communications Mgt.	5 th	4 th
P. Risk Mgt.	4 th	1 st
P. Procurement Mgt.	6 th	7 th
P. Stakeholder Mgt.	6 th	5 th

* Source: (Nguyen et al., 2017) results for Europe

2.6.4. Overview from the presented studies

In Table 12 are summarized the results from the four studies presented.

As addressed in the scientific literature, it is visible that there is a tendency to have the knowledge areas from the golden triangle scoring the best, with at least one of them in the top three on each study. It is also visible that the results from the different studies do not converge.

Table 12. Summary of the main studies about knowledge areas importance.

	Degree of practice *	Extent of use **	Importance to Project Success **	Importance ***	Adoption ***	Perceived Maturity ***	Extent of use ****	Teaching priority ****
P. Integration Mgt.	4 th	1 st	5 th	3 rd	3 rd	3	9 th	9 th
P. Scope Mgt.	2 nd	3 rd	3 rd	1 st	2 nd	3	3 rd	8 th
P. Time Mgt.	1 st	2 nd	1 st	2 nd	7 th	3	1 st	2 nd
P. Cost Mgt.	3 rd	5 th	8 th	2 nd	5 th	3	1 st	3 rd
P. Quality Mgt.	8 th	7 th	6 th	2 nd	1 st	4	8 th	10 th
P. HR Mgt.	5 th	4 th	4 th	4 th	8 th	2	10 th	6 th
P. Communications Mgt.	7 th	8 th	7 th	4 th	4 th	3	5 th	4 th
P. Risk Mgt.	9 th	6 th	2 nd	6 th	9 th	3	4 th	1 st
P. Procurement Mgt.	6 th	9 th	9 th	5 th	5 th	2	6 th	7 th
P. Stakeholder Mgt.	Not studied	Not studied	Not studied	Not studied	Not studied	Not studied	6 th	5 th

* Source: (Papke-Shields et al., 2010)

** Source: (Zwikael, 2009)

*** Source: (Abdul Rasid et al., 2014)

**** Source: (Nguyen et al., 2017) results for Europe

3. Methodological approach

3.1. Research objectives

As addressed before, the importance of projects within SMEs for economy has already been realized. However, a big gap still exists in research associating project management and SMEs scopes. This investigation intends to investigate how project management can be leveraged to promote the growth of SMEs. By studying the degree of knowledge, importance, and extent of use given by SME managers in Lourinhã municipality to each of the ten Knowledge Areas from PMBOK® Guide fifth edition, this study aims to offer guidance on equipping managers with the necessary tools and techniques to foster project management application. The specific objectives are as follow:

1. Appoint which project management knowledge areas SME managers have better knowledge in and in which they lack knowledge the most;
2. Appoint which project management knowledge areas SME managers consider more and which they consider less relevant;
3. Perceive the application degree of each project management knowledge area by SME managers;
4. Define training guidelines for the local community of SMEs.

With the intent to achieve the research objectives, bibliometric and systematic literature review was held. This allowed to identify the relevance of the thematic, define the state-of-art and understand the research gap.

After defining the state-of-art and understanding the research gap, quantitative research for the empirical research on Lourinhã's took place to further compare results with what was found in the bibliometric and systematic literature review and accomplish the research objectives. Quantitative research was held by surveying SME managers from Lourinhã municipality. At first, a questionnaire survey was formulated in Google Forms, composed of four main sections: the characterization of the company and the respondent; the experience of the respondent in management; the Project Management in the company; and the evaluation of each project management knowledge area. The respondents were first approached by phone, from 10th May until 30th May 2023. Right after a successful contact, the survey was sent by e-mail to each company. A follow up e-mail was also sent by Lourinhã Municipality on 31th May to the missing respondents. Data collection took approximately one month, with the survey being closed on 13th June.

The questionnaire, population and sample will be presented bellow, along with the analysis of the responses.

3.2. Bibliometric and systematic literature review

In order to better understand the research gap, the results from the search in Scientific Repositories were analyzed, a Systematic literature review and chronological, co-authorship and terms co-occurrence analyses were held. The results from this analysis will be presented in this chapter.

3.2.1. Articles selection

After exploratory research, the research keywords *SMEs*, *Project management*, *Project manager*, *SME manager*, and *Knowledge areas* were defined and the following search queries were created to fetch the relevant articles for each section of the Literature Review presented:

- Query 1 - ("SME" or "SMEs") and "Project Management":
 - SME concept;
 - SME importance to economy;
 - Project management research on SMEs.
- Query 2 - ("SME Manager" or "SME Managers") and ("Project Manager" or "Project Managers"):
- Query 3 - ("SME" or "SMEs") and "project management" and "Knowledge Areas":
 - Project management knowledge areas importance on SMEs.
- Query 4 - "project management" and "Knowledge Areas" and "importance":
 - Project management knowledge areas importance.

Science Direct (SD) and Web of Science (WoS) were chosen as data sources. On Table 13 is presented the number of articles returned by search performed.

Search by Title, Abstract and Keywords on SD and search by Topic on WoS were preferred above other search types, as they return the most relevant articles. However, for the second and third queries, search by Terms were chosen for SD since searching by Title, Abstract and Keywords returned only one article for each query.

Table 13. Total of articles returned by search.

Search	Total from search
S1 Science Direct - Title, Abstract and Keywords	35
S1 Science Direct - Terms	1885
S1 Web of Science - Topic	122
S1 Web of Science – All fields	175
S2 Science Direct - Title, Abstract and Keywords	1
S2 Science Direct - Terms	27
S2 Web of Science - Topic	1
S2 Web of Science – All fields	1
S3 Science Direct - Title, Abstract and Keywords	1
S3 Science Direct - Terms	50
S3 Web of Science - Topic	1
S3 Web of Science – All fields	1
S4 Science Direct - Title, Abstract and Keywords	2
S4 Science Direct - Terms	499
S4 Web of Science - Topic	15
S4 Web of Science – All fields	15

* Own authorship

After selecting which search type to use (Title, Abstract and Keywords; Terms; Topic; or All fields), duplicated and inaccessible documents were filtered. Documents were further filtered by pertinence to the study by reading abstracts, conclusions. For the literature review, only articles published in reference journals for Quartile 1 and 2 were considered, resulting in twelve articles from search 1 and five articles from search 4. Searches 2 and 4 returned no relevant results. The origin of the seventeen articles used for the literature review can be seen in Appendix B- Quartile table and information sources. A summary of the articles selection is shown in Table 14.

A more detailed outlook on the results from each query and filtering process can be found in Appendix A- Article selection process per search Query.

Table 14. Summary of the articles selection.

Search	Total from search	Articles since 2012 (included)	Total since 2012 (included)	After filtering duplicates and not accessible	Total (accessible not duplicated)	Selected by reading	Selected (Q1/Q2)
S1 Science Direct - Title, Abstract and Keywords	35	22	117	21	105	36	12
S1 Web of Science - Topic	122	95		84			
S2 Science Direct - Terms	27	21	22	21	22	5	
S2 Web of Science – Topic	1	1		1			
S3 Science Direct - Terms	50	46	47	45	46	12	
S3 Web of Science – Topic	1	1		1			
S4 Science Direct - Title, Abstract and Keywords	2	2	17	2	13	6	5
S4 Web of Science - Topic	15	15		11			

* Own authorship

Evaluating the number of articles found in the Scientific repositories, sideways with the results from the literature review, it was possible to conclude that even though project management is a popular topic among the research community, its relation to SMEs is shortly studied. The low number of articles found while comparing to other search topics is evidence of that. It was also noticeable the lack of definition of the project manager's and SME manager's profile, as no relevant articles were found as a result from the second search. This denotes the lack of studies about the manager as a key player on projects or on SMEs activity.

Nevertheless, the research gap regarding this specific study was most evident with the lack of results from search 3. As this study intends to sort project management knowledge areas by degree of importance, knowledge and application, it was concluded that no similar study was undertaken for SMEs, since no relevant article addressed both SMEs, project management and knowledge areas topics. Consequently, the fourth search query was created, with the intent to find studies sorting knowledge areas by importance under the general domain, not only SMEs. Even though the number of relevant articles were not extensive, results could be found to extent of use, importance, perceived maturity and teaching priority for different geographical regions and industries.

The results from the research on the scientific repositories provided further evidence of the need to conduct a study relating project management knowledge areas to SMEs.

3.2.2. Chronological analysis

Having as base the four search queries presented, and the topics underlying to them, a chronological analysis was held to better understand the relevance of each topic over time. The total of articles returned by each query (presented on Table 13) were graphically represented in function of the year of publication on Figure 1.

Each line represents the sum of the articles returned when: searching by Title, Abstract or Keywords on CD; searching by Terms on CD; searching by All fields on WoS; and searching by Topic on WoS.

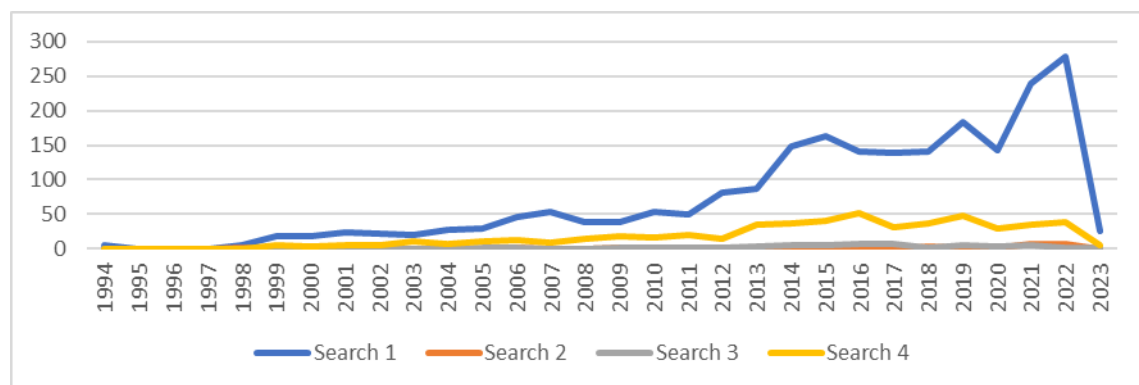


Figure 1. Number of documents by search query – SD (TAK and Terms), WoS (All fields and Topic)

It's visible a prevalence of results from search 1, under the most generic thematic: "SME" and "Project management". Search 4 appears as the second with the most results, under the thematic "Project management", "Knowledge areas", and "Importance".

Studies relating SMEs and Project Management had its seminal articles in 1994, with the number of documents starting to rise since 1998, showing a rising tendency still nowadays. It is a recent field of study, what justifies the sparse literature available. The two seminal articles, published in 1994, addressed the following thematic: one related a design course with project management and an SME student paper context (Lekhukul & Higgins, 1994); and the other studied how strategic-planning concepts can apply at the SME level for sustainable competitive advantage on construction SMEs (Belts, 1994). Even though the relation with project management was weak, those articles were the starting point for the link between SME and project management thematic in the academy.

An identical graphic was created (Figure 2) considering only the search type selected for each search: Title, Abstract and Keywords for searches 1 and 4 on Science direct; Terms for searches 2 and 3 on Science Direct; and Topic for all searches on Web of Science.

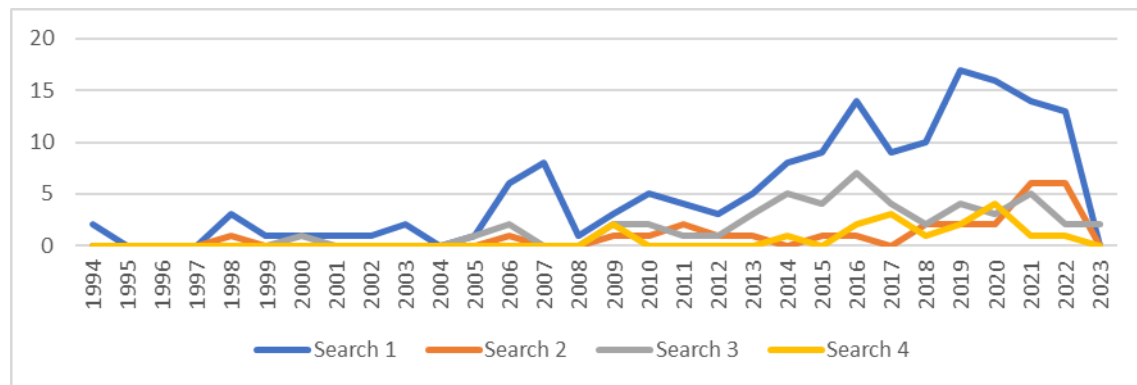


Figure 2. Number of documents from selected sources by search query

In general, the conclusions taken above are also valid when considering this subset of documents. It can be further concluded that research relating Project management, Knowledge areas and Importance (search 4) had two seminal articles in 2009: one assessed the value of a set of skills and knowledge areas of Industrial Hygiene graduates on their proficiency to find and perform their first job, including project management as a “business skills” (Brosseau & Fredrickson, 2009); and the other justifies the importance of sorting the project management Knowledge Areas according to its level of significance, exploring the relative importance of the project management Knowledge Areas used during the planning phase of a project and their impact on project success (Zwikael, 2009). The second seminal article exposed revealed of high importance to the topic under study, being the first one not only addressing the importance of sorting the knowledge, providing justification for doing so, but also delivering a ordination of the nine knowledge areas presented by PMI on its PMBOK® Guide 4th Edition (PMI, 2008). The article of Zwikael (2009) represented an important reference for this study.

The theme addressed on the fourth search, specifically the importance of each project management knowledge area, shown to be more recent topic while compared to the other three. As referred its seminal articles where published on 2009, however the topic got traction for the academy, with the number of publications rising only since 2015.

Conclusions about the second and third searches were not addressed as they didn’t return relevant documents to this research.

3.2.3. Co-authorship analysis

In order to better understand the interactions between the authors co-authorship analysis were held to two sets of articles: All the articles returned by the selected search type published since 2012 - relate to *Total since 2012 (included)* column on Table 14; and the articles selected for the systematic literature review - relate to *Selected (Q1/Q2)* column on the same table. The study of the first set aimed to get an overview of the work done related to the search topic, and the study of the second one

intended to understand the relation between authors from the articles selected for the systematic literature review.

The table below (Table 15) summarizes the results of first co-authorship analysis, held to the articles returned by the selected search type and published since 2012. The steps taken to draw the conclusions bellow can be found in Appendix C- Co-authorship Analyses.

Table 15. Summary from co-authorship analysis to documents published since 2012.

Search Criteria		N ^{er} of documents	VOSviewer arguments	Results	Results (link strength > 3)
Total		191	Min. n ^{er} author = 2	31 authors 17 clusters	11 authors 3 clusters
	Query: ("SME" or "SMEs") and "Project Management"				
S1	SD by TAK	117	Min. n ^{er} author = 2	17 authors	8 authors
	WoS by Topic			8 cluster	2 clusters
	Query: ("SME Manager" or "SME Managers") and ("Project Manager" or "Project Managers")				
S2	SD by Terms	22	Min. n ^{er} author = 1	83 authors	26 authors
	WoS by Topic			21 clusters	5 clusters
	Query: ("SME" or "SMEs") and "project management" and "Knowledge Areas"				
S3	SD by Terms	47	Min. n ^{er} author = 2	6 authors	3 authors
	WoS by Topic			3 clusters	1 cluster
	Query: "Project Management" and "Knowledge Areas" and "Importance"				
S4	SD by TAK	17	Min. n ^{er} author = 1	38 authors	5 authors
	WoS by Topic			15 clusters	1 cluster

* Own authorship

The analysis was done to the complete set of documents, and to the articles returned by each search query independently. All returned a considerable high number of clusters while compared with the number of authors. This means work is being done within teams, but there is not much collaboration across teams. The fact that this are understudied and relatively recent fields of study may also lead to having authors working in silos according to the study niche of their specialization. As the studies under Project Management, SMEs and Knowledge Areas broadens, and more articles are published, collaboration naturally increases thus reducing this silo effect.

Regarding queries 2 and 4, due to the low number of documents under study the co-authorship analysis considered authors with only 1 document published, instead of 2. This resulted on less relevant authors, with lower number of publications being considered, increasing the number of authors and clusters. While analyzing Table 15 it is noticeable that search 2 and 4 even though having less documents under analyses, still have the higher number of authors and clusters, however results from searches 2 and 4 are not comparable with others.

It is also important to note that most documents from searches 2 and 3 were found by terms which organically returns documents that are not so relevant to the topic. That fact was already confirmed

while filtering the articles by reading (Table 14). While comparing the co-authorship analysis results from search 2 to search 4, the high number of authors and cluster for search 2 also suggested that the results were not focused in a specific thematic, thus the thematic under study. However the number of articles had the same magnitude, query 2 returned more than twice the number of authors returned by query 4. The number of clusters was also considerably higher for query 2, however with not such a considerable difference while compared with the number of authors.

A co- authorship analysis following the same approach was taken to the articles selected for the systematic literature review. The results can be seen in Table 16. The steps taken to draw the conclusions bellow can be found in Appendix C- Co-authorship Analyses.

Table 16. Summary from co-authorship analysis to documents used for the systematic literature review.

Search Criteria		N ^{er} of documents	VOSviewer arguments	Results	Results (link strength > 3)
Total		17	Min. n ^{er} author = 1	37 authors 13 clusters	8 authors 2 clusters
S1	SD by TAK WoS by Topic	12	Min. n ^{er} author = 1	23 authors 8 cluster	8 authors 2 clusters
S4	SD by TAK WoS by Topic	5	Min. n ^{er} author = 1	14 authors 5 clusters	0 authors 0 cluster

* Own authorship

The analysis was done to the complete set of documents, and to the articles returned by each search query independently. Since no document resulting from queries 2 and 3 where considered for the systematic literature review, those were not considered for this analysis.

The small number of documents under study made it harder to draw conclusions. It was however visible the high number of authors and clusters while compared with the number of documents, keeping the validity of the conclusions drawn before also for this subset of documents.

In order to better understand the relation between the number of articles and the number of authors, the mean of number of articles per document was calculated. It is important to refer that the value mean was not calculated as the total number of authors divided by the number of documents. As the same author may create more than one document, the mean was calculated as the summatory of the number of authors of each document, divided by the number of documents. Results can be found on (Table 17).

Table 17. Mean of number of authors per article.

Search Criteria		N ^{er} of documents	Mean of number of authors per document
Total		17	2,76
S1	SD by TAK WoS by Topic	12	2,75
S4	SD by TAK WoS by Topic	5	2,8

* Own authorship

After considering Table 16 and Table 17, since the number of authors per document is similar for the 3 scenarios under study (Total, S1 and S2), the number of authors and clusters can also be compared while considering the number of documents.

At first, since both sum of the number of authors and the sum of the number of clusters for search 1 and search 4 is the same as for the total, can be concluded that no author is present on both searches. This was expectable as the first search was done under Project Management for SMEs and the fourth one was one under project management knowledge areas importance, two different niches of study for the academy.

The number of authors and clusters was considerably high on both searching, specially for the search 4. For the fourth search $N^{er} documents * Mean documents per author = 13,82$. Since the number of authors from search 4 is 14, this means that almost all authors had a single publication. However, for the first search $N^{er} documents * Mean documents per author = 33,6$. Since the number of authors from search 1 is 23, this evidences that some authors had more than one single publication under analysis. This already evidences the existence of authors having the focus on the thematic Project Management for SMEs, the main thematic of this study.

As addressed before, the first search addressed a broader thematic which had its seminal article earlier, already has a bigger focus for the academy and is more consolidated. Thus, it is expectable that there are already reference authors working on such thematic with more than one publication. It is also important to note that the selection was biased by the selection of articles done by reading, however the existence of multiple articles of the same author still provides evidence that the thematic is being studied further by a specific group of academics, something that did not happen for the fourth search.

On the other hand, documents returned by query 4 used for the literature review were mostly studies addressing a specific industry or geographical area. Thus, since researchers conducting this

type of research are usually linked to the industry or area under study, it is expectable that all articles have different authors.

3.2.4. Term co-occurrence analysis

In order to better understand the relation between words and group them by topic and meaning, a co-occurrence analysis was held. Abstracts were manually inserted to Mendeley software, and a .Ris file was generated to do the respective analyses on VOSviewer. The analysis in this section will all take in consideration title and abstract of the documents.

Such as with the co-authorship analysis, it will be held to two sets of articles: All the articles returned by the selected search type published since 2012 - relate to *Total since 2012 (included)* column on Table 14; and the articles selected for the systematic literature review - relate to *Selected (Q1/Q2)* column on Table 14. A more detailed analysis of the terms cooccurrence analysis by search can be found in Appendix D- Term co-occurrence analysis.

When analyzing all documents, the default value of minimum 10 occurrences was kept. Of 3723 terms, 68 meet the threshold, remaining 41 terms with a relevance score of at least 60%. The number of terms to include in the graph (Figure 3 and Figure 4) was reduced to 30 in order to better visualize the most relevant data. Terms were organized by the software in 4 clusters, namely: cluster 1 regarding case studies and challenges in SMEs; cluster 2 regarding evidence of impact and innovation of frameworks; cluster 3 regarding the gap in the importance and the gap about project management in the literature; and cluster 4 with not so relevant topics, such as change and sustainability.

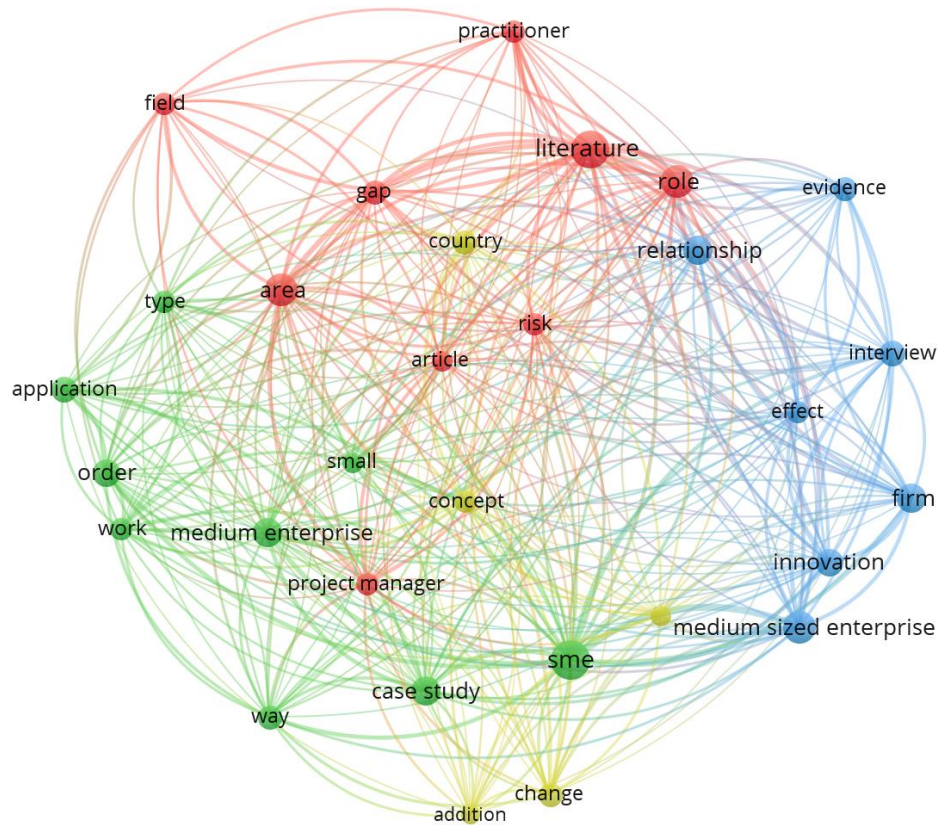


Figure 3. Term co-occurrences analyses to documents from the selected search type published since 2012 - network visualization

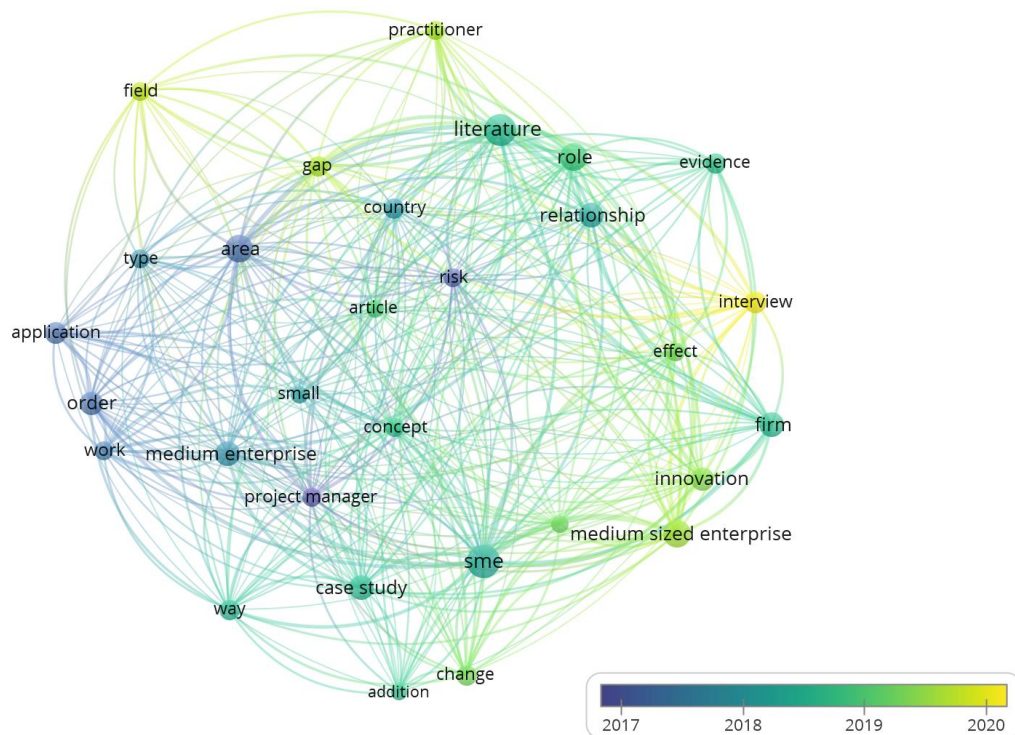


Figure 4. Term co-occurrences analyses to documents from the selected search type published since 2012 - overlay visualization

The proximity of project manager to SME, medium sized enterprise, innovation, and change was noticeable. The inclusion of the word gap was also important to this study. It was unexpected that project management was not shown in the network.

In the overlay visualizations, it could also be noticed that project manager is an older research topic than SME, innovation, or gap. This corroborates the idea that the gap between SMEs and project management is getting focus to the academy and that literature relating both thematic is relatively more recent.

When analyzing the results from the four searches separately, it was noticeable that results from searches two, three and four were not as relevant as the results from the first search. This was expectable as those searches returned a lower number of articles, but also because they were not so connected to the topic under study, thus being more heterogeneous on the topics addressed. A more detailed outlook on analysis by search query can be found in Appendix D- Term co-occurrence analysis.

On the other hand, when considering all documents returned by the four research queries it is noticeable the presence of the word gap. From the 3723 terms found, to have gap in the 30 more important ones, with a direct link to literature and medium sized enterprise, denotes the academy endorses the need focus on medium sized enterprises. The proximity of certain terms such as project management, SME, innovation and change also suggests the importance of project management to SMEs, as a motor force of the required innovation to survive, adapt and grow.

Such as concluded on the chronological analysis, on the overlay visualizations was possible to evidence that studies related to SMEs are more recent than studies under project management topic, a more generic topic and thus more consolidated focus of study for the scientific community.

When analyzing the 17 articles used for the literature review, the default value of minimum 10 occurrences was kept. Of 399 terms, 6 meet the threshold, remaining 4 terms with a relevance score of at least 60%. The four terms were part of a single cluster (Figure 5 and Figure 6).

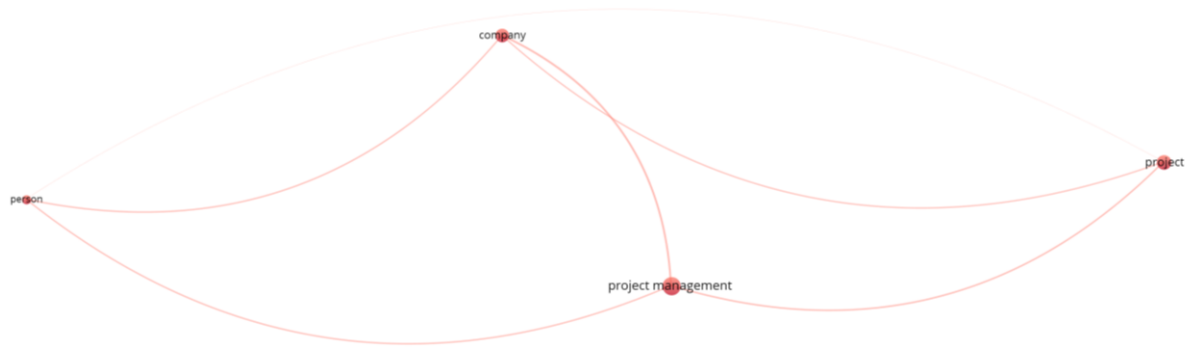


Figure 5. Term co-occurrences analyses to documents used for the literature review – network visualization

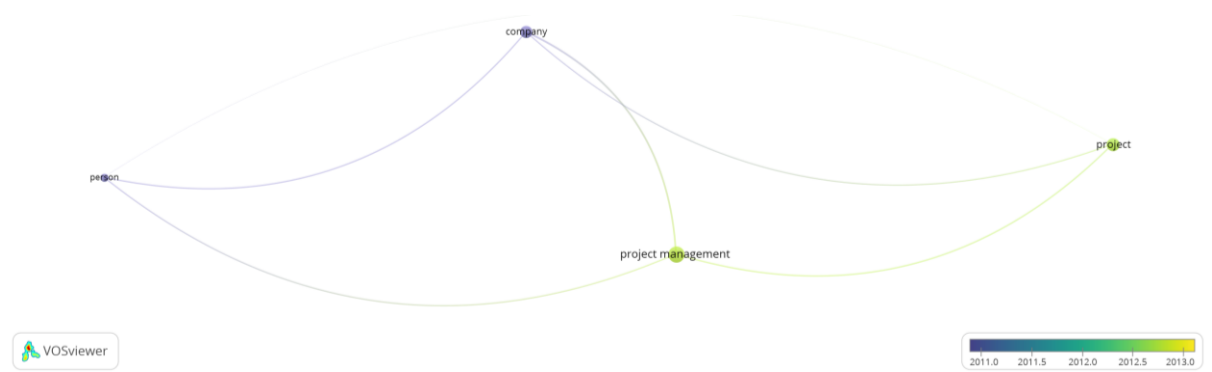


Figure 6. Term co-occurrences analyses to documents used for the literature review – overlay visualization

From the graph, it is possible to see that project management acts as a connection between the person, as an individual, and the project. Company is also part of this connection. The overlay shown no significant chronological difference between terms, as it was ranging from 2011 to 2013.

As the number of documents under analysis was small, the parameters were adjusted with the intent to achieve better results. The value of minimum occurrences was changed to 5. Of 399 terms, 28 meet the threshold, remaining 17 terms with a relevance score of at least 60%. The terms were organized in four clusters: the first regarding project management knowledge areas studies; the second regarding company growth, SME and person; the third relating medium enterprises, skill, use and practice; and the fourth connecting industry, project management tools and techniques (Figure 3, Figure 7 and Figure 8).

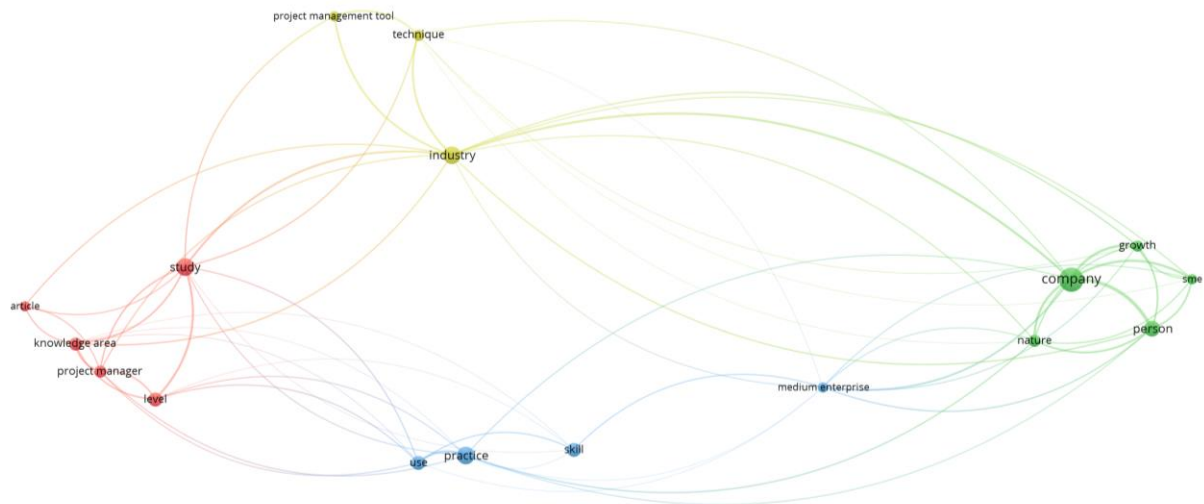


Figure 7. Term co-occurrences analyses to documents used for the literature review (min. 5 occurrences) – network visualization

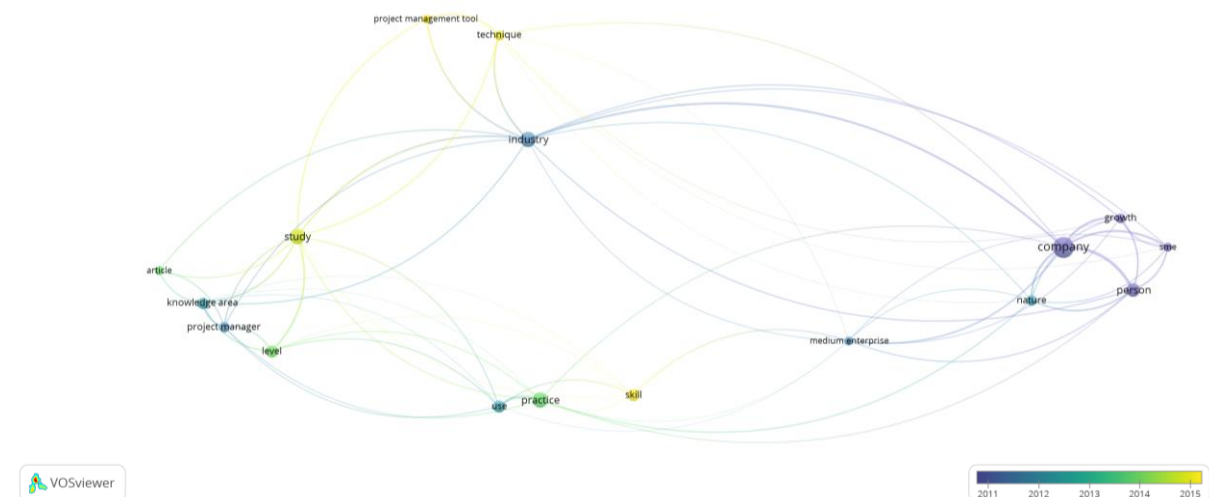


Figure 8. Term co-occurrences analyses to documents used for the literature review (min. 5 occurrences) – overlay visualization

As a conclusion, it is possible to notice on the articles used for the literature review the proximity of the word study with project manager and knowledge area. This is in line with the intent of this study. It is also possible to understand the importance of project management tools and techniques as those appeared in the graph. On other hand it was also noticeable the proximity of SME, growth, person and company noticing the focus on studying company growth with the human agent in focus. Once again, this topic also shown to be in focus before the ones more with higher relation to project management, however there was no significant chronological difference between terms. Industry was presented as the main point of relation between company growth, project management tools and techniques as the studies regarding project manager and knowledge areas. However with weaker strength, practice also

allowed the link between the first cluster, with the strongest relation to project management, and the second one, regarding company growth.

3.3. Research approach

3.3.1. Questionnaire

A questionnaire survey was created to conduct the quantitative research for the empirical research on Lourinhã. The survey was split in three main logical sections (Figure 9), intended to: provide understanding on the scope of research and involved parties and raise awareness on the importance of project management to SMEs; collect information regarding the company, the manager and the usage of project management on the company; and understand the degree of knowledge, importance and application of each 10 project management knowledge areas.

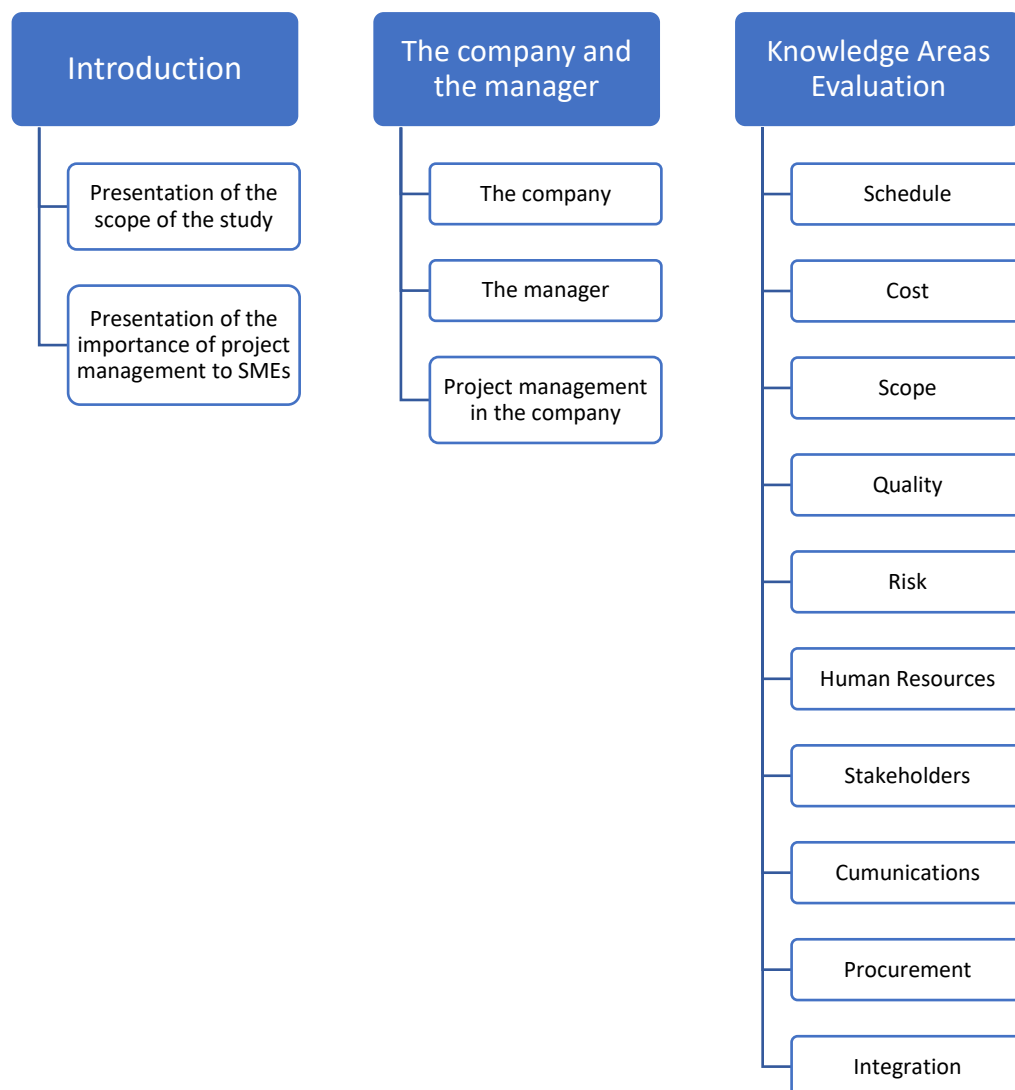


Figure 9. Survey's logical structure

Every explanatory section of the survey was exposed both in text and video, to increase engagement and ease understanding of the topics. This approach was held since according to the company's characterization and during pre-tests the population of managers shown to have low levels of formal education. The sections recorded in video were: the presentation of the importance of project management to SMEs; the explanation of the way each project management knowledge area was going to be evaluated; and the explanation of each project management knowledge area.

To collect data to characterize the company, the following questions were done:

- , Taxpayer number (with which number of employees could be found);
- , Activity sectors.

To collect data to characterize the manager, the following questions were done:

- , Age;
- , Gender;
- , Academic qualifications;
- , If holds a middle of top management role. If yes:
 - o Experience in management roles (in years);
 - o If holds any project management training/education/certification. If yes, which.

To collect data to characterize the use of project management in the company, the following questions were done:

- , If the company runs projects;
- , How many project are running for the time being;
- , If there is any department responsible for project management in the company.

On the third logical part, the degree of knowledge, importance and application given to each project management knowledge area was self-assessed by the respondent. Each project management knowledge area was presented by its definition and the list of processes it contains, according PMBOK® Guide (PMI, 2013). For each knowledge area the three variables – knowledge, importance and application – were self-assessed by the respondent on a 5-point Likert-Scale from 1 – Strongly disagree to 5 – Strongly Agree.

Pre-tests were held to three companies before survey was rolled out to the population under study. Companies selected for pre-tests were part of the three main business areas, namely wholesale and retail trade; construction of buildings; and agriculture, animal production, hunting and related

service activities. Efforts were taken to take pre-tests from two small and one medium sized enterprise, without success. Thus, the three companies were small-sized enterprises, employing 14, 18 and 28 people.

As a result from pre-tests the questionnaire survey suffered changes with the intended to make it more user-friendly and easier to understand since respondent's shown not to understand some concepts. Explanatory sections of the survey were also exposed in video format as stated before. The following changes were done resulting from pre-tests:

- The title was changed from "Which Project Management Knowledge Areas do SME's Managers value the most?" – the title of this dissertation – to "Project Management in Lourinhã's SMEs" since having the same question repeated on the header of the questionnaire survey, to which respondents did not have to provide an answer was confusing some respondents;
- A simpler explanation of Project Integration Management was done, since this knowledge area proved to be of harder comprehension;
- The Short-cycle tertiary education academical degree was added since it was missing;
- Information of years taken at school for lower and upper secondary education was added, since respondents were confused with naming of academical degrees due to changes of naming conventions over time;
- Complexity was reduced by removing references to the origins of information, such as "According to PMBOK® Guide...";
- Synonyms and examples were added in brackets on processes used in each knowledge areas, to ease comprehension on the processes;
- Some words were changed by synonyms of easier comprehension.

3.4. Context of the study

3.4.1. Geographic contextualization

In order to better understand the suitability of this study along with the characteristics of the respondents companies and the responses collected, it is important to start by introducing the Lourinhã Municipality main characteristics.

The municipality of Lourinhã is part of the Portuguese *Região Oeste*. It belongs to the district of Lisbon and is located 63 km north of its headquarters. Also integrating the *Região de Lisboa e Vale do*

Tejo (Litoral Estremadura), the municipality has an area of 146 km², with a population of over 25,000 inhabitants.

In terms of accessibility, Lourinhã is served by national roads; motorway, whose accesses are located close to the municipality; and public transport, in large numbers and with different schedules covering the entire municipality. Those infrastructures allow greater proximity to Torres Vedras, Caldas da Rainha, Óbidos and Bombarral and to large centers such as Lisbon and Leiria.

Due to its geographic duality, with an agricultural area that occupies 80% of its territory and a coastline of about 12 km, the main economic activities of the municipality are fishing and agriculture, with the retail sector also assuming a significant weight in its economy.

The natural resources it has, combined with the existing infrastructure, make Lourinhã a municipality where the sea, the countryside and historical tradition come together. This creates a foundation for the Municipality to seek for a sustained development and for the well-being of its population and visitors (Município da Lourinhã, 2023).

With the intent to find solutions for sustained development, Lourinhã Municipality patronized this study. With the results from this research, the entity seeks for strategies to better invest on fostering SMEs growth, since they are the great majority of enterprises from the region.

3.4.2. Population

From a total of 1040 active companies in Lourinhã Municipality, 902 are micro enterprises, 137 small and medium enterprises and 1 is large scale enterprise, representing 86,73%, 13,17% and 0,1% of the universe, respectively.

Regarding SMEs (137), the majority employees less than 20 people (57,7%) and has a turnover of less than 2 million euros 59,9%. Considering that SMEs employ from 10 to 250 people, and has turnovers of 2 to 50 million Euros, it is visible that Lourinhã SMEs distribution is not uniform, existing a predominance of small-sized companies. As mentioned previously, in this study only the threshold of computing stuff is being considered to discriminate companies by size. It is however important to refer that from the SMEs under study, 59,9% has turnover lower than 2 million euros and 2,2% has turnovers higher than 50 million euros. Hence, only the remaining 6,6% SMEs meet the thresholds of turnover. This data also denotes the comparatively small scale of Lourinhã SMEs while compared with the measures set by European Union.

Table 18. Lourinhã Municipality SMEs by number of employees

Ner of employees	Ner of companies	Percent	Cumulative Percent
10 to 20	79	57,7%	57,7%
21 to 30	22	16,1%	73,7%
31 to 40	9	6,6%	80,3%
41 to 50	4	2,9%	83,2%
51 to 60	3	2,2%	85,4%
61 to 70	2	1,5%	86,9%
71 to 80	0	0,0%	86,9%
81 to 90	3	2,2%	89,1%
91 to 100	1	0,7%	89,8%
101 to 110	0	0,0%	89,8%
111 to 120	0	0,0%	89,8%
121 to 130	0	0,0%	89,8%
131 to 140	0	0,0%	89,8%
141 to 150	1	0,7%	90,5%
150 to 250	4	2,9%	93,4%
Not available	9	6,6%	100,0%

* Source: (Sabi, 2023)

Table 19. Lourinhã Municipality SMEs by turnover (20 million euros scale)

Turnover (millions)	N ^{er} of companies	Percent	Cumulative Percent
Less than 1	56	40,9%	40,9%
1 to 20	72	52,6%	93,4%
20 to 40	5	3,6%	97,1%
40 to 60	1	0,7%	97,8%
60 to 80	1	0,7%	98,5%
80 to 100	0	0,0%	98,5%
100 to 120	0	0,0%	98,5%
120 to 140	0	0,0%	98,5%
140 to 160	0	0,0%	98,5%
160 to 180	0	0,0%	98,5%
180 to 200	0	0,0%	98,5%
200 to 220	1	0,7%	99,3%
Not available	1	0,7%	100,0%

* Source: (Sabi, 2023)

Table 20. Lourinhã Municipality SMEs by turnover (1 million euros scale)

Turnover (millions)	N ^{er} of companies	Percent	Cumulative Percent
Less than 1	56	40,9%	40,9%
1 to 2	26	19,0%	59,9%
2 to 3	16	11,7%	71,5%
3 to 4	7	5,1%	76,6%
4 to 5	5	3,6%	80,3%
5 to 6	6	4,4%	84,7%
6 to 7	1	0,7%	85,4%
7 to 8	6	4,4%	89,8%
8 to 9	2	1,5%	91,2%
9 to 10	0	0,0%	91,2%
10 to 11	2	1,5%	92,7%
11 to 12	0	0,0%	92,7%
12 to 13	0	0,0%	92,7%
13 to 14	0	0,0%	92,7%
14 to 15	0	0,0%	92,7%
15 to 16	1	0,7%	93,4%
16 to 17	0	0,0%	93,4%
17 to 18	0	0,0%	93,4%
18 to 19	0	0,0%	93,4%
19 to 20	0	0,0%	93,4%
More than 20	8	5,8%	99,3%
Not available	1	0,7%	100,0%

* Source: (Sabi, 2023)

Regarding SMEs distribution by main activity, the activity codes with the higher count of companies are: Wholesale; and Retail trade. Each has 16 companies, corresponding to a cumulative percentage of 23,2%. Real estate development, construction of buildings; and Agriculture, animal production, hunting and related service activities also share a equal split of 14 companies each. In fifth position are 10 companies dedicated to Fishing and aquaculture with a share of 7,2% of the SMEs under study. The 5 activities addressed above represent 50,7% of the companies under study, from a total of 62 different main activities represented in this same universe.

Table 21. Lourinhã Municipality SMEs by main activity

Principal CAE (division)	Description **	N ^{er} of companies	Percent	Cumulative Percent
46	Wholesale, except motor vehicles and motorcycles	16	11,6%	11,6%
47	Retail trade, except motor vehicles and motorcycles	16	11,6%	23,2%
41	Real estate development (development of building projects); construction of buildings	14	10,1%	33,3%
01	Agriculture, animal production, hunting and related service activities	14	10,1%	43,5%
03	Fishing and aquaculture	10	7,2%	50,7%
49	Land transport and transport by oil or gas pipelines	9	6,5%	57,2%
56	Food and beverages	8	5,8%	63,0%
10	Food industries	8	5,8%	68,8%
43	Specialized construction activities	6	4,3%	73,2%
87	Social support activities with accommodation	6	4,3%	77,5%
88	Social support activities without accommodation	4	2,9%	80,4%
25	Manufacture of metallic products, except machinery and equipment	3	2,2%	82,6%
28	Manufacture of machinery and equipment	2	1,4%	84,1%
31	Manufacture of furniture and mattresses	2	1,4%	85,5%
69	Legal and accounting activities	2	1,4%	87,0%
08	Other extractive industries	2	1,4%	88,4%
	Others (frequency= 1)	16	11,6%	100,0%

* Source: (Sabi, 2023)

** Values translated by the author of this study

3.4.3. Sample

From a population of 137 SMEs, a sample of 62 companies was gathered. 53 companies were considered small, having less than 50 employees and 9 medium-sized, representing 85,5% and 14,5% respectively. Regarding the number of employees, the minimum value was 10, maximums 185, with a mean of 29,58 and a standard deviation of 35,782.

A total of 13 companies performed Agriculture, animal production, hunting, forestry, and fishing activities. 11 performed Construction activities. 8 performed: Manufacturing industries; 8 Wholesale and retail trade; and 8 Transport and storage. 7 performed Human health and social support activities. 4 performed Accommodation, catering and similar. 2 performed Financial and insurance activities. 5 other respondents performed activities in other areas such as Extractive industries; Electricity, gas and water; Leisure tourist activities; Real estate activities; and Education. Only one company performed one activity which was not listed, namely Auto Inspection Center. It is important to consider that each company could choose multiple options, thus the sum of responses is higher than 62 and cumulative percentages are not shown since they do not make sense in this case.

Table 22. Activities performed by the respondent SMEs

Activity *	N ^{er} of companies	Percent
Agriculture, animal production, hunting, forestry, and fishing activities	13	21,0%
Construction activities	11	17,7%
Manufacturing industries	8	12,9%
Wholesale and retail trade	8	12,9%
Transport and storage	8	12,9%
Human health and social support activities	7	11,3%
Accommodation, catering and similar	4	6,5%
Financial and insurance activities	2	3,2%
Extractive industries	1	1,6%
Electricity, gas and water	1	1,6%
Leisure tourist activities	1	1,6%
Real estate activities	1	1,6%
Education	1	1,6%
Others	1	1,6%

* Values translated by the author of this study

From the sample 58,1% of the companies do projects. 45,2% had no project running at that moment, 40,3 % had 1 to 3 projects running, 8,1% had 4 to 7 projects and 6,5% had more than 7 projects running at that moment. Only 17,7% had a department responsible for Project Management.

Table 23. Number of projects running in the respondent SMEs

Number of projects	N ^{er} of respondents	Percent	Cumulative Percent
0	28	45,2%	45,2%
1 to 3	25	40,3%	85,5%
4 to 7	5	8,1%	93,5%
More that 7	4	6,5%	100,0%

Regarding survey's respondents, 41 were male, 20 female and 1 preferred not to respond, representing 66,1%, 32,3% and 1,6% respectively. The mean of ages of the respondents was 48,87 with a minimum of 29, a maximum of 79 and a standard deviation of 11.163.

56,5% did not have higher education with 41 respondents having lower secondary education and 21 upper secondary education. Only 6 had a master's or equivalent level and 2 had doctoral or equivalent level, corresponding to 9,7% and 3,2% of the respondents respectively.

Table 24. Respondent's gender

Gender	N ^{er} of respondents	Percent
Male	41	66,1%
Female	20	32,3%
Prefers not to respond	1	1,6%

Table 25. Respondents academic education degree

Academic education degree	N ^{er} of respondents	Percent	Cumulative Percent
Lower secondary education	41	22,6%	22,6%
Upper secondary education	21	33,9%	56,5%
Short-cycle tertiary education	3	4,8%	61,3%
Bachelor's or equivalent level	13	21,0%	82,3%
Postgraduate	3	4,8%	87,1%
Master's or equivalent level	6	9,7%	96,8%
Doctoral or equivalent level	2	3,2%	100,0%

From the respondents, 57 stated to holds a top or middle management position in the company, while 5 did not. From the top and middle managers, 35 had more than 15 years in management, representing 61,4% of the 57 respondents.

Table 26. Respondents experience in management

Experience in Management	N ^{er} of respondents	Percent	Valid Percent	Cumulative Percent
Less that 5 years	3	4,8%	5,3%	5,3%
From 5 to 10 years	11	17,7%	19,3%	24,6%
From 10 to 15 years	8	12,9%	14,0%	38,6%
More that 15 years	35	56,5%	61,4%	100,0%
Missing	5	8,1%		

Despite that 6 respondents answered to have project management education, representing 10,5% of the top and middle manager, while stating the course none shown to be the case. The answers provided while asked to indicate the course were: Management for the competitiveness of SMEs; Accounting and Public Management; Master's in Applied Management - Major in Operations Management; Hotel Management course (duration 9 months) and Waiter course; Post-Graduation in Management of Health Units - Catholic University; As part of the Postgraduate course in Business and Organization Management.

4. Results

4.1. Variables

Before holding the various statistical analyses, it is important to introduce the variables under study, explaining their names, types and what they represent.

The main variables are: the Individual/Corporate Taxpayer number (NIPC_NIF) from which the number of employees (N_Employees) and the company size (Comp_Size) could be found; the list activity sectors selected by the respondent from the checkbox list (Sector_text); if the company performs other activity not listed in the questionnaire (Other_Sector); the names of the other activities input by the respondent (Other_Sector_text); the respondent's age (Respondent_Age); the respondent's gender (Gender); the respondents education (Education); if the respondent is middle or top manager (Is_Manager); the respondent's experience in management jobs (Mngt_Experience); if the inquired manager has any specific course/training/certification in project management (Has_PM_education); the names of the project management course/training/certification the respondent holds (PM_education_text); if the company has projects running (Run_Projects); the number of projects running at the moment in the company (N_Running_Projects); and if the company has a department responsible for project management (Has_PM_Dptm).

The self-assesed values of knowledge, importance and application for the 10 knowledge areas where also gathered in 30 variables. The naming of the variables was created with a prefix according to the knowledge area (TIME_ for time, COST_ for cost, SCOPE_ for scope, QUA_ for quality, RISK_ for risk, HR_ for human resources, SH_ for stakeholders, COM_ for communications, PROC_ for procurement, INT_ for integration) and a suffix according to the dimension (KNO for knowledge, IMP for importance, APP for application).

From the list of selected activity sectors selected by the respondent (Sector_text), 13 others Boolean variables were created. Each represented one activity sector from the 13 activity sectors presented in the list from which the respondent could select.

The description and type of each variable can be found on Table 27. Three variables were presented on the Table but not directly used in the study namely: the survey submission date (Submisison_Date); if the respondent accepted the RDPG clause (GDPR); and if the response was provided after the follow up of Lourinhã's Municipality by e-mail (Is_Lnh_Response). This last variable allowed to track the effect of the follow up e-mail sent by Lourinhã Municipality on the response rate of the questionnaire survey. From the 62 respondents, 15 responded after the follow up e-mail from Lourinhã municipality, comprising an increase of 32% on the response rate.

Table 27. Variables used for the study

Variable Name	Variable type	Variable Description
Submission_Date	Date	Survey submission date
GDPR	Boolean	If GDPR was accepted
NIPC_NIF	Numeric	Individual/Corporate Taxpayer number
Sector_text	String	List of selected activity sectors in text
Sector1	Boolean	Performs agriculture, animal production, hunting, forestry, and fishing activities
Sector2	Boolean	Performs construction activities
Sector3	Boolean	Performs manufacturing industries
Sector4	Boolean	Performs wholesale and retail trade activities
Sector5	Boolean	Performs transport and storage activities
Sector6	Boolean	Performs human health and social support activities
Sector7	Boolean	Performs accommodation, catering and similar activities
Sector8	Boolean	Performs financial and insurance activities
Sector9	Boolean	Performs extractive industries related activities
Sector10	Boolean	Performs electricity, gas and water related activities
Sector11	Boolean	Performs leisure tourist activities
Sector12	Boolean	Performs real estate activities
Sector13	Boolean	Performs education activities
Other_Sector	Boolean	Performs other activities
Other_Sector_text	String	List of other performed activities
Respondent_Age	Numeric	Inquired manager's age
Gender	Enumerate	Inquired manager's gender
Education	Enumerate	Inquired manager's education
Is_Manager	Boolean	Is middle or top manager
Mngt_Experience	Enumerate	Inquired manager's experience in management
Has_PM_education	Boolean	If the inquired manager has any specific course/training/certification in project management
PM_education_text	String	List of inquired manager's course/training/certification in project management
Run_Projects	Boolean	If the company has projects running
N_Running_Projects	Enumerate	Number of projects running in the company for the time being
Has_PM_Dptm	Boolean	If the company has a project management department
TIME_KNO	Numeric	Self-assessed Degree of Knowledge of Time Management
TIME_IMP	Numeric	Self-assessed Degree of importance of Time Management
TIME_APP	Numeric	Self-assessed Degree of Application of Time Management
COST_KNO	Numeric	Self-assessed Degree of Knowledge of Cost Management
COST_IMP	Numeric	Self-assessed Degree of importance of Cost Management
COST_APP	Numeric	Self-assessed Degree of Application of Cost Management
SCOPE_KNO	Numeric	Self-assessed Degree of Knowledge of Scope Management
SCOPE_IMP	Numeric	Self-assessed Degree of importance of Scope Management
SCOPE_APP	Numeric	Self-assessed Degree of Application of Scope Management
QUA_KNO	Numeric	Self-assessed Degree of Knowledge of Quality Management
QUA_IMP	Numeric	Self-assessed Degree of Importance of Quality Management
QUA_APP	Numeric	Self-assessed Degree of Application of Quality Management
RISK_KNO	Numeric	Self-assessed Degree of Knowledge of Risk Management
RISK_IMP	Numeric	Self-assessed Degree of Importance of Risk Management
RISK_APP	Numeric	Self-assessed Degree of Application of Risk Management
HR_KNO	Numeric	Self-assessed Degree of Knowledge of Human Resource Management
HR_IMP	Numeric	Self-assessed Degree of Importance of Human Resource Management

HR_APP	Numeric	Self-assessed Degree of Application of Human Resource Management
SH_KNO	Numeric	Self-assessed Degree of Knowledge of Stakeholder Management
SH_IMP	Numeric	Self-assessed Degree of Importance of Stakeholder Management
SH_APP	Numeric	Self-assessed Degree of Application of Stakeholder Management
COM_KNO	Numeric	Self-assessed Degree of Knowledge of Communications Management
COM_IMP	Numeric	Self-assessed Degree of Importance of Communications Management
COM_APP	Numeric	Self-assessed Degree of Application of Communications Management
PROC_KNO	Numeric	Self-assessed Degree of Knowledge of Procurement Management
PROC_IMP	Numeric	Self-assessed Degree of Importance of Procurement Management
PROC_APP	Numeric	Self-assessed Degree of Application of Procurement Management
INT_KNO	Numeric	Self-assessed Degree of Knowledge of Integration Management
INT_IMP	Numeric	Self-assessed Degree of Importance of Integration Management
INT_APP	Numeric	Self-assessed Degree of Application of Integration Management
Is_Lnh_Response	Boolean	If the response was submitted after the follow up of Lourinhã's Municipality by e-mail
Comp_Size	Enumerate	Company size
N_Employees	Numeric	Company's number of employees

However each variable's type can be seen in Table 27, some has specific restrictions of type which are further elaborate on Table 28, such as the numeric values and enumerates..

Table 28. Type restriction of specific variables

Variable Name	Accepted values
NIPC_NIF	9 digits natural number
Respondent_Age	Natural number
Gender	{0: Male; 1: Female; 2: Prefer not to say}
Education	{1: Lower secondary education; 2: Upper secondary education; 3: Short-cycle tertiary education; 4: Bachelor's or equivalent level; 5: Postgraduate; 6: Master's or equivalent level; 7: Doctoral or equivalent level}
N_Running_Projects	{1: 0; 2: 1 to 3; 3: 4 to 7; 4: More that 7}
*_KNO	[1; 5] ∈ N
*_IMP	[1; 5] ∈ N
*_APP	[1; 5] ∈ N
Comp_Size	{0: Small; 1: Medium}
N_Employees	[10; 250] ∈ N

4.2. Knowledge Areas Mean Scores

In order understand the general degree of knowledge, importance and application of each respondent, the mean was calculated as follow:

- The project management knowledge of each respondent (KNO_mean) was calculated as the mean of the values of self-assessed knowledge of each knowledge area (TIME_KNO, COST_KNO, SCOPE_KNO, QUA_KNO, RISK_KNO, HR_KNO, SH_KNO, COM_KNO, PROC_KNO, INT_KNO).

- The importance given to project management by each respondent (IMP_mean) was calculated as the mean of the values of self-assessed importance of each knowledge area (TIME_IMP, COST_IMP, SCOPE_IMP, QUA_IMP, RISK_IMP, HR_IMP, SH_IMP, COM_IMP, PROC_IMP, INT_IMP).
- The degree of application for project management practices by each respondent (APP_mean) was calculated as the mean of self-assessed application of each knowledge area (TIME_APP, COST_APP, SCOPE_APP, QUA_APP, RISK_APP, HR_APP, SH_APP, COM_APP, PROC_APP, INT_APP).

The creation of these variables also allowed to compare the general degree of knowledge, importance and application. Results can be shown in Table 29.

Table 29 - Descriptive statistics of means of Degree of Knowledge, Importance and Application

	N	Minimum	Maximum	Mean	Std. Deviation	Cronbach's Alpha
KNO_mean	62	1,00	5,00	3,6581	1,00842	0,978
IMP_mean	62	1,30	5,00	3,9968	,94017	0,984
APP_mean	62	1,00	5,00	3,4145	1,03763	0,977
Valid N (listwise)	62					

On average respondents assessed the degree of knowledge (KNO_mean) as 3,66, importance (IMP_mean) as 4,00 and application (APP_mean) as 3,41. The internal consistency of the variables was good for knowledge, importance and application variables, with Cronbach's Alpha values higher than 0,977. The degree of importance had the highest score, followed by knowledge and application.

To compare the results from the survey with the knowledge areas ordination found in the literature review (Table 12), the mean values of degree of knowledge (KNO_mean), importance (IMP_mean) and application (APP_mean) were used. Knowledge areas were then classified from first to last on descending order of means. Results can be found in Table 30.

Table 30 - Responses to the Degree of Knowledge, Importance and Application of each KA

	Degree of Knowledge			Degree of Importance			Degree of Application		
	Position	Mean	Std. Dev.	Position	Mean	Std. Dev.	Position	Mean	Std. Dev.
P. Integration Mgt.	7 th	3,58	1,049	4 th	4,03	1,008	5 th	3,37	1,134
P. Scope Mgt.	9 th	3,55	1,082	8 th	3,90	1,020	8 th	3,27	1,104
P. Time Mgt.	5 th	3,66	1,086	3 rd	4,10	,936	9 th	3,26	1,115
P. Cost Mgt.	2 nd	3,79	1,073	1 st	4,16	,995	2 nd	3,58	1,124
P. Quality Mgt.	3 rd	3,76	1,169	6 th	3,98	1,048	4 th	3,50	1,184
P. HR Mgt.	4 th	3,74	1,085	5 th	4,02	1,000	3 rd	3,52	1,170
P. Communications Mgt.	10 th	3,53	1,112	10 th	3,84	1,027	10 th	3,24	1,141
P. Risk Mgt.	6 th	3,60	1,166	7 th	3,94	1,022	7 th	3,32	1,128
P. Procurement Mgt.	1 st	3,82	1,124	2 nd	4,11	1,026	1 st	3,73	1,176
P. Stakeholder Mgt.	8 th	3,55	1,082	9 th	3,89	,977	6 th	3,35	1,103

4.3. Multiple Linear Regression

Multiple regression analysis is a statistical technique that can be used to analyze the relationship between a single dependent (criterion) variable and several independent (predictor) variables. The objective of multiple regression analysis is to use the independent variables whose values are known to predict the single dependent value selected by the researcher. Each independent variable is weighted by the regression analysis procedure to ensure maximal prediction from the set of independent variables. The weights denote the relative contribution of the independent variables to the overall prediction and facilitate interpretation as to the influence of each variable in making the prediction, although correlation among the independent variables complicates the interpretative process. Thus, it can equally achieve the objectives of prediction or explanation (Hair et al., 2019).

In addition, linear models predict values that fall in a straight line by having a constant unit change (slope) of the dependent variable for a constant unit change of the independent variable. For example, in the population model $Y = b_0 + b_1X_1 + \varepsilon$, the effect of changing X_1 by a value of 1.0 is to add b_1 (a constant) units of Y (Hair et al., 2019).

In the following sections, exploratory research will be done to create three models with the intent to understand the influence of the manager's background and the company characteristics on the degree of knowledge (KNO_mean), importance (IMP_mean) and application (APP_mean) assessed by the managers. The independent variables will be: the age of the respondent (Respondent_Age); the education degree hold by the respondent (Education); the experience of the respondent in management (Mngt_Experience); the number of projects running at the company (N_Running_Projects); and the number of employees of the company (N_employees).

Despite not having evidence on the literature review regarding the existence of dependency relations between the variables, this understanding will allow to further assess the most impacting variable on the degree of knowledge, importance and application of project management practices. It will also ease understanding the best approach for the training guidelines to be defined. As the dependency relation between variables was not defined in advance, the ANOVA method was used to assess the effect of the independent variables on the dependent ones.

For the multiple linear regression modules the stepwise method was used. Stepwise regression is a method of multiple regression in which variables are entered into the model based on a statistical criterion (the semi-partial correlation with the outcome variable). Once a new variable is entered into the model, all variables in the model are assessed to see whether they should be removed (Field, 2017). These eases conducting exploratory research, since the software used, IBM SPSS, decides which variables to include and exclude in the model presenting itself the final model along with information of the decisions and analysis done.

4.3.1. Degree of Knowledge

The purpose of the first model was to understand how the self-assessed degree of knowledge on project management (KNO_mean) was influenced by: the age of the respondent (Respondent_Age); the education degree hold by the respondent (Education); the experience of the respondent in management (Mngt_Experience); the number of projects running at the company (N_Running_Projects); and the number of employees of the company (N_employees).

From the creation of the model, using stepwise method, only the number of running projects (N_Running_Projects) and the respondent's age (Respondent_Age) showed to have a statistical correlation on the variable under study, in this case the self-assessed knowledge of the manager on project management (KNO_mean).

Table 31 – Variables Entered/Removed, Dependent Variable: KNO_mean

Model	Variables Entered	Variables Removed	Method
1	N_Running_Projects		Stepwise (Criteria: Probability-of-F-to-enter <= ,050, Probability-of-F-to-remove >= ,100).
2	Respondent_Age		Stepwise (Criteria: Probability-of-F-to-enter <= ,050, Probability-of-F-to-remove >= ,100).

The model presented a $R_a^2 = 0,292$, meaning 29,2% of the total variance of *KNO_mean* is explained by the independent variables. This means that the identified independent variables, even

though significant, are not accounting for much of the mean of the dependent variable. Durbin-Watson value is 1,848. Since $d \approx 2,0 (\pm 0,2)$, the assumption that the residuals are not correlated is validated.

Table 32 – Model Summary, Dependent Variable: KNO_mean

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	0,496 ^a	,246	,232	,91383	
2	0,563 ^b	,317	,292	,87766	1,848

a. Predictors: (Constant), N_Running_Projects
b. Predictors: (Constant), N_Running_Projects, Respondent_Age

The ANOVA test was also held. For the second model $H_0: \beta_1 = \dots = \beta_m = 0$ was rejected with a confidence level of 5%. This means the model is significative since there is at least one independent variable with a significative effect on the dependent variable. The model is highly significative as $p \text{ value} < ,001$.

Table 33 –ANOVA, Dependent Variable: KNO_mean

Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	14,957	1	14,957	17,911 ^a
	Residual	45,929	55	0,835	
	Total	60,887	56		
2	Regression	19,291	2	9,646	12,522 ^b
	Residual	41,595	54	0,770	
	Total	60,887	56		

a. Predictors: (Constant), N_Running_Projects
b. Predictors: (Constant), N_Running_Projects, Respondent_Age

On the Coefficients table is possible to verify that the two variables included in the second model are significative for a confidence level of 5%, since according to Bonferroni correlation $\alpha = \frac{0,05}{2} = 0,025$ and $p \text{ value} < ,025$ for both variables. The variables also present no problems of multicollinearity as tolerance is close to 1 and $VIF < 3$ for both variables included.

Table 34 - Coefficients, Dependent Variable: KNO_mean

Model		Unstandardized Coefficients		Beta	t	Sig.	Collinearity Statistics	
		B	Std. Error				Tolerance	VIF
1	(Constant)	2,617	0,276		9,483	0,000		
	N_Running_Projects	0,587	0,139	0,496	4,232	0,000	1,000	1,000
2	(Constant)	1,345	0,598		2,248	0,029		
	N_Running_Projects	0,613	0,134	0,518	4,591	0,000	0,993	1,007
	Respondent_Age	0,025	0,010	0,268	2,372	0,021	0,993	1,007

The adjusted model is:

$$KNO_mean = 1,345 + 0,613 N_Running_Projects + 0,025 Respondent_Age$$

Analyzing the histogram of residuals (Figure 35), they look to follow a distribution close to normal. In the Normal P-P Plot of Regression Standardized Residual (Figure 36) the points are close to the diagonal, being expectable that the residuals follow a distribution close to normal.

The One-Sample Kolmogorov-Smirnov Test was held to test the normality of the residual's distribution. With $p = 0,200$, for a significance level of 5% the null hypotheses H_0 : *The variable follows a normal distribution* was not rejected, confirming the residuals follow a normal distribution. This validates the assumption of residual mean null and constant variance.

Table 35 – One-Sample Kolmogorov-Smirnov Test, Dependent Variable: KNO_mean

		Unstandardized Residual
N		62
Normal Parameters ^{a, b}	Mean	0,0242897
	Std. Deviation	0,83824445
Test Statistic		0,085
Asymp. Sig. (2-tailed) ^c		,200 ^d

- a. Test distribution is Normal.
- b. Calculated from data.
- c. Lilliefors Significance Correction.

4.3.2. Degree of Importance

Similarly with the previous model, a second one was created to understand how the self-assessed degree of importance given to project management practices (IMP_mean) was influenced by: the age of the respondent (Respondent_Age); the education degree hold by the respondent (Education); the experience of the respondent in management (Mngt_Experience); the number of projects running at the company (N_Running_Projects); and the number of employees of the company (N_employees).

Such as for the previous model presented, the stepwise method was used on IBM SPSS software. Only the number of running projects (N_Running_Projects) showed to have a statistical correlation on the variable under study, in this case the self-assessed degree of importance given to project management practices (IMP_mean).

Table 36 – Variables Entered/Removed, Dependent Variable: IMP_mean

Model	Variables Entered	Variables Removed	Method
1	N_Running_Projects		Stepwise (Criteria: Probability-of-F-to-enter <= ,050, Probability-of-F-to-remove >= ,100).

The model presented a $R_a^2 = 0,181$, meaning 18,1% of the total variance of *IMP_mean* is explained by the independent variable. This means that the identified independent variables, even though significant, are not accounting for much of the mean of the dependent variable. . Durbin-Watson value is 1,805. Since $d \approx 2,0 (\pm 0,2)$, the assumption that the residuals are not correlated is validated.

Table 37 – Model Summary, Dependent Variable: IMP_mean

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,442a	0,195	0,181	0,87094	1,805
a. Predictors: (Constant), N_Running_Projects					

The ANOVA test was also held. $H_0: \beta_1 = \dots = \beta_m = 0$ was rejected with a confidence level of 5%. This means the model is significative since there is at least one independent variable with a significative effect on the dependent variable. The model is highly significative as $p \text{ value} < ,001$.

Table 38 –ANOVA, Dependent Variable: IMP_mean

Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	10,124	1	10,124	13,346 ^a
	Residual	41,719	55	0,759	
	Total	51,843	56		
a. Predictors: (Constant), N_Running_Projects					

On the Coefficients table is possible to verify that the variable included is significative for a confidence level of 5%, since according to Bonferroni correlation $\alpha = \frac{0,05}{1} = 0,05$ and $p \text{ value} < ,05$. The variables also present no problems of multicollinearity as tolerance is 1 and $VIF < 3$ for the variable included.

Table 39 - Coefficients, Dependent Variable: IMP_mean

Model		Unstandardized Coefficients		Beta	t	Sig.	Collinearity Statistics	
		B	Std. Error				Tolerance	VIF
1	(Constant)	3,168	0,263		12,045	0,000		
	N_Running_Projects	0,483	0,132	0,442	3,653	0,001	1,000	1,000

The adjusted model is:

$$IMP_mean = 3,168 + 0,483 N_Running_Projects$$

Analyzing the histogram of residual (Appendix E- Figure 37), it shows a close to a normal distribution. In the Normal P-P Plot of Regression Standardized Residual (Appendix E- Figure 38) the points are close to the diagonal, being expectable that the residuals follow a distribution close to normal.

The One-Sample Kolmogorov-Smirnov Test was held to test the normality of the residuals distribution. With $p = 0,060$, for a significance level of 5% the null hypotheses H_0 : *The variable follows a normal distribution* was not rejected, confirming the residuals follow a normal distribution. This validates the assumption of residual mean null and constant variance.

Table 40 – One-Sample Kolmogorov-Smirnov Test, Dependent Variable: IMP_mean

		Unstandardized Residual
N		62
Normal Parameters ^{a, b}	Mean	-0,019648
	Std. Deviation	,83685208
Test Statistic		,110
Asymp. Sig. (2-tailed) ^c		,060

- a. Test distribution is Normal.
- b. Calculated from data.
- c. Lilliefors Significance Correction.

4.3.3. Degree of Application

A third model was created to understand how the self-assessed degree of application of project management practices (APP_mean) was influenced by: the age of the respondent (Respondent_Age); the education degree hold by the respondent (Education); the experience of the respondent in management (Mngt_Experience); the number of projects running at the company (N_Running_Projects); and the number of employees of the company (N_employees).

The stepwise method on IBM SPSS was used. Only the number of running projects (N_Running_Projects) and the respondent's age (Respondent_Age) showed to have a statistical correlation on the variable under study, in this case the self-assessed degree of application of project management practices (APP_mean).

Table 41 – Variables Entered/Removed, Dependent Variable: APP_mean

Model	Variables Entered	Variables Removed	Method
1	N_Running_Projects		Stepwise (Criteria: Probability-of-F-to-enter <= ,050, Probability-of-F-to-remove >= ,100).
2	Respondent_Age		Stepwise (Criteria: Probability-of-F-to-enter <= ,050, Probability-of-F-to-remove >= ,100).

The model presented a $R_a^2 = 0,246$, meaning 24,6% of the total variance of *APP_mean* is explained by the independent variables. This means that the identified independent variables, even though significant, are not accounting for much of the mean of the dependent variable. Durbin-Watson value is 2,054. Since $d \approx 2,0 (\pm 0,2)$, the assumption that the residuals are not correlated is validated.

Table 42 – Model Summary, Dependent Variable: APP_mean

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	,433 ^a	0,187	0,172	0,97544	
2	,522 ^b	0,273	0,246	0,93105	2,054
a. Predictors: (Constant), N_Running_Projects					
b. Predictors: (Constant), N_Running_Projects, Respondent_Age					

The ANOVA test was also held. For the second model $H_0: \beta_1 = \dots = \beta_m = 0$ was rejected with a confidence level of 5%. This means the model is significative, since there is at least one independent variable with a significative effect on the dependent variable. The model is highly significative as $p\text{ value} < ,001$.

Table 43 –ANOVA, Dependent Variable: APP_mean

Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	12,046	1	12,046	12,660 ^a
	Residual	52,331	55	0,951	
	Total	64,377	56		
2	Regression	17,567	2	8,783	10,133 ^b
	Residual	46,810	54	0,867	
	Total	64,377	56		
a. Predictors: (Constant), N_Running_Projects					
b. Predictors: (Constant), N_Running_Projects, Respondent_Age					

On the Coefficients table is possible to verify that the two variables included in the second model are significative for a confidence level of 5%, since according to Bonferroni correlation $\alpha = \frac{0,05}{2} = 0,025$ and $p\text{ value} < ,025$ for both variables. The variables also present no problems of multicollinearity as tolerance is close to 1 and $VIF < 3$ for both variables included.

Table 44 - Coefficients, Dependent Variable: APP_mean

Model		Unstandardized Coefficients		Beta	t	Sig.	Collinearity Statistics	
		B	Std. Error				Tolerance	VIF
1	(Constant)	2,465	0,295		8,368	0,000		
	N_Running_Projects	0,526	0,148	0,433	3,558	0,001	1,000	1,000
2	(Constant)	1,029	0,635		1,621	0,111		
	N_Running_Projects	0,557	0,142	0,457	3,928	0,000	0,993	1,007
	Respondent_Age	0,028	0,011	0,294	2,524	0,015	0,993	1,007

The adjusted model is:

$$APP_mean = 1,029 + 0,557 N_Running_Projects + 0,028 Respondent_Age$$

While Analyzing the histogram of residual (Appendix E- Figure 39), the distribution looks to be close to normal. In the Normal P-P Plot of Regression Standardized Residual (Appendix E- Figure 40) the points are close to the diagonal, being expectable that the residuals follow a distribution close to normal.

The One-Sample Kolmogorov-Smirnov Test was held to test the normality of the residuals distribution. With $p = 0,200$, for a significance level of 5% the null hypotheses H_0 : *The variable follows a normal distribution* was not rejected, confirming the residuals follow a normal distribution. This validates the assumption of residual mean null and constant variance.

Table 45 – One-Sample Kolmogorov-Smirnov Test, Dependent Variable: APP_mean

		Unstandardized Residual
N		62
Normal Parameters ^{a, b}	Mean	,0403620
	Std. Deviation	,88776845
Test Statistic		,072
Asymp. Sig. (2-tailed) ^c		,200 ^d

- a. Test distribution is Normal.
- b. Calculated from data.
- c. Lilliefors Significance Correction.

4.3.4. Comparison of the models

After conducting the multiple linear regression to understand the effect of the manager's background and the company characteristics on the degree of knowledge (KNO_mean), importance (IMP_mean) and application (APP_mean) assessed by the managers, the following models were created:

$$KNO_mean = 1,345 + 0,613 N_Running_Projects + 0,025 Respondent_Age$$

$$IMP_mean = 3,168 + 0,483 N_Running_Projects$$

$$APP_mean = 1,029 + 0,557 N_Running_Projects + 0,028 Respondent_Age$$

The three models presented similar results, excluding manager's education degree (Education); the years of experience from the manager in management (Mngt_Experience); and the number of employees of the company (N_employees). Oppositely the three models included the number of projects running at the company (N_Running_Projects), while the respondents age (Respondent_Age) shown to be relevant to assess only the degree of knowledge (KNO_mean) and application (APP_mean) of project management practices, but was not relevant to assess the importance given to them (IMP_mean) (Table 46).

Table 46. Included and excluded variables to each linear regression model

Dependent variable	Respondent_Age	Education	Mngt_Experience	N_Running_Projects	N_employees
KNO_mean	Included	Excluded	Excluded	Included	Excluded
IMP_mean	Excluded	Excluded	Excluded	Included	Excluded
APP_mean	Included	Excluded	Excluded	Included	Excluded

Regarding the degree of knowledge (KNO_mean) and application (APP_mean), the number of running projects in the company (N_Running_Projects) shown to have a much stronger positive influence on the dependent variable than the respondent's age (Respondent_Age).

4.4. Compare Means – Small vs Medium-sized Enterprises

In order to understand if the differences of the degree of knowledge (KNO_mean), importance (IMP_mean) and application (APP_mean) of project management practices were statistically different for small and medium-sized enterprises, a comparison of means was held for this variable for the two groups (Comp_Size).

To conduct this analysis, the assumption of normality was validated for the three variables (KNO_mena, IMP_mean and APP_mean) for the two groups (Comp_Size).

For the tests of normality, H_0 : *The variable follows a normal distribution.*

For the degree of knowledge:

- Small enterprises returned $p = 0,077$ on Kolmogorov-Smirnov test, hence for a significance level of 5% the null hypotheses was not rejected, confirming the assumption of normality;
- Medium enterprises returned $p = 0,200$ on Shapiro-Wilk test and $p = 0,321$ on Kolmogorov-Smirnov test, hence for a significance level of 5% the null hypotheses was not rejected on both tests, confirming the assumption of normality.

For the degree of importance:

- Small enterprises returned $p < 0,001$ on both Shapiro-Wilk test and Kolmogorov-Smirnov test, hence for a significance level of 5% the null hypotheses was rejected on both tests. However, as the sample is larger than 30 ($N = 53$) according to the central limit theorem the variables can be considered to follow a normal distribution. (Field, 2017)
- Medium enterprises returned $p = 0,200$ on Shapiro-Wilk test and $p = 0,063$ on Kolmogorov-Smirnov test, hence for a significance level of 5% the null hypotheses was not rejected on both tests, confirming the assumption of normality.

For the degree of application:

- Small enterprises returned $p = 0,028$ on Shapiro-Wilk test and $p = 0,011$ on Kolmogorov-Smirnov test, hence for a significance level of 5% the null hypotheses was rejected on both tests. However, as the sample is larger than 30 ($N = 53$) according to the central limit theorem the variables can be considered to follow a normal distribution. (Field, 2017)
- Medium enterprises returned $p = 0,200$ on Shapiro-Wilk test and $p = 0,819$ on Kolmogorov-Smirnov test, hence for a significance level of 5% the null hypotheses was not rejected on both tests, confirming the assumption of normality.

Conclusively, the assumption of normality was verified in all above cases.

Table 47 –Test of Normality for KNO_mean, IMP_mean and APP_mean: Small and Medium enterprises.

	Size	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
KNO_mean	Small	0,115	53	0,077	0,936	53	0,007
	Medium	0,197	9	,200*	0,911	9	0,321
IMP_mean	Small	0,171	53	0,001	0,898	53	0,000
	Medium	0,209	9	,200*	0,843	9	0,063
APP_mean	Small	0,129	53	0,028	0,941	53	0,011
	Medium	0,134	9	,200*	0,962	9	0,819

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Other assumption to be tested if the homogeneity of variance. The Levene's Test of Equality of variances was held, following H_0 : *The variable present the same variance*. Since for the three variables $p > 0,05$, for a significance level of 5% the null hypotheses was not rejected. Thus, the assumption of homogeneity of variances was assumed.

Table 48 –Independent Samples Test for KNO_mean, IMP_mean and APP_mean: Small and Medium enterprises.

Model		Levene's Test for Equality of Variances		t-test for Equality of Means						95% Confidence Interval of the Difference	
		F	Sig.	t	df	Significance		Mean Difference	Std. Error Difference	Lower	Upper
						One-Sided p	Two-Sided p				
1	Equal variances assumed	1,530	0,221	-1,286	60	0,102	0,203	-0,46499	0,36163	-1,18835	0,25838
	Equal variances not assumed			-1,651	14,224	0,060	0,121	-0,46499	0,28158	-1,06802	0,13804
2	Equal variances assumed	1,708	0,196	-1,283	60	0,102	0,204	-0,43270	0,33717	-1,10715	0,24174
	Equal variances not assumed			-1,547	13,083	0,073	0,146	-0,43270	0,27980	-1,03678	0,17137
3	Equal variances assumed	0,216	0,644	-0,438	60	0,331	0,663	-0,16499	0,37659	-0,91829	0,58831
	Equal variances not assumed			-0,456	11,262	0,329	0,657	-0,16499	0,36182	-0,95909	0,62911

In order to check the equality of means of knowledge, importance and application (KNO_mean, IMP_mean and APP_mean) for small and medium sized enterprises (Comp_Size), t-test of equality of means where held, where H_0 : *The mean are equal for both groups*. Since for the three variables $p > 0,05$, for a significance level of 5% the null hypotheses was not rejected. Thus, the differences self-assessed degree of knowledge, importance and application of project management practices are not statistically different for small and medium-sized enterprises participating in this study.

However the values of means where not statistically different for small and medium-sized enterprises, from the boxplot graphs in Figure 10, Figure 11 and Figure 12 can be understood that the companies where evaluating the degree of knowledge, importance and application differently, with medium companies having higher values.

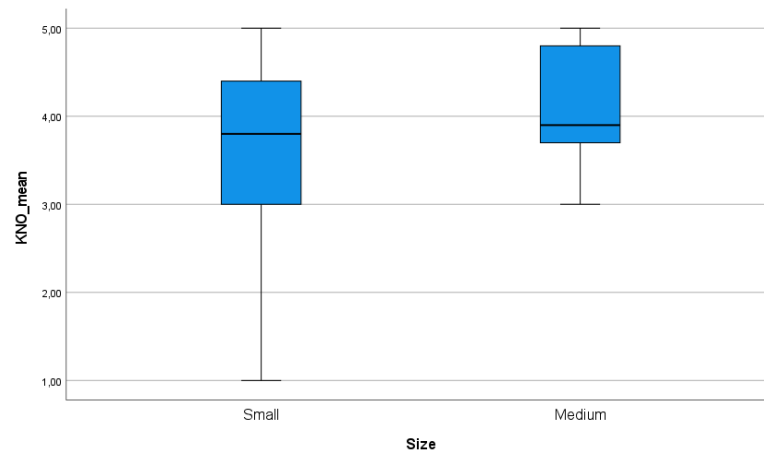


Figure 10. Boxplot of KNO_mean by company size

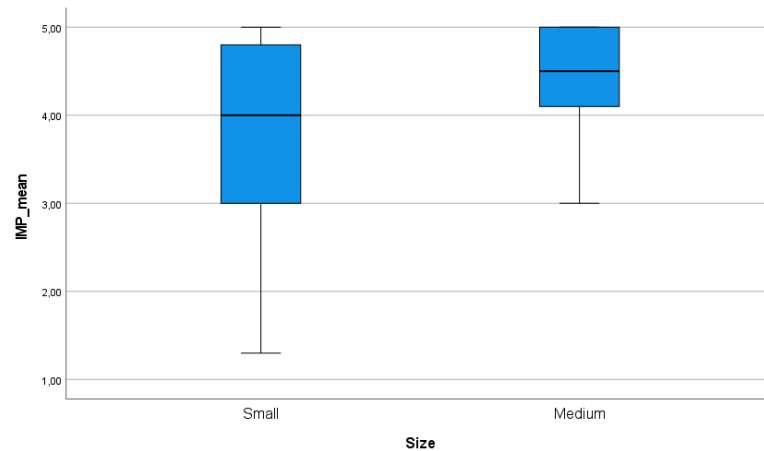


Figure 11. Boxplot of IMP_mean by company size

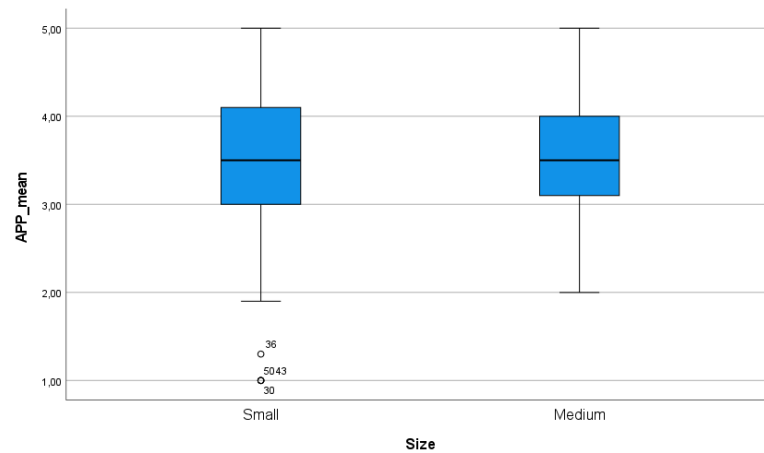


Figure 12. Boxplot of APP_mean by company size

4.5. Results Discussion

In this section the results from the empirical research will be discussed and compared with what was found during the systematic literature review.

While comparing the average value of the self-assessed degree of knowledge, importance and application of project management practices by the SME managers, the degree of importance had the highest score, followed by the degree of knowledge, with the degree of application scoring the lower value.

Since the intent of this research is to define training guidelines for the community of SME managers, it is a good starting point that the degree of importance had the higher value, suggesting that the SME managers understand the importance of project management. This is already a starting point as the community shares the view of the academy which states that project management is critical to the survival of small organizations (Marcelino-Sádaba et al., 2014). The fact that the SME managers recognize the importance of project management and acknowledge a lower degree of knowledge and application of such practices may suggest the respondents are available to act either by learning and applying such practices.

From survey answer analysis, respondents shown to have poor knowledge on the subject. As an example, 6 respondents answered to have project management education, however when analyzing the course's names none of them shown to be the case. This may justify and even suggest that even though the average degree of knowledge was in second place, it may be overestimated due to the nescience regarding the topic.

The fact that the degree of application scored the lower while compared with knowledge and importance, is not only a consequence from the lack of knowledge but may also uphold the results of the study of Hertogh et al. (2010) which concluded that project management practices are considered too bureaucratic to SMEs.

Regarding the sorting of each knowledge areas by degree of knowledge, importance and application, they did not follow what was expected from the literature review.

At first, the KAs part of the “iron triangle” (Atkinson, 1999) were not the top ones. From all the KA scope was one of lower evaluated ones, holding the 9th position for degree of knowledge and 8th for importance and application. This reveals a colossal gap on project management knowledge and in the ability to apply the skills, as scope management is one of the main basis for project success. Time management, also part of the “iron triangle” was on 5th position for knowledge, 3rd for importance and 9th for application. The fact that this KA was in 9th place on the degree of application is also a point of concern since it is of topmost importance to project success. The only KA from the “iron-triangle” that was on top positions was cost management, holding the 1st position for importance and the 2nd for degree of knowledge and application.

On the other side, from the literature review no evidence was found that procurement management would stand out, however it was on 1st position for knowledge and application and 2nd for the degree of knowledge. In summary, the 1st and 2nd positions were occupied by cost and procurement management for the three variables assessed.

While cost and procurement hold the top positions, communications management was the last KA for degree of knowledge, importance and application. This is in part in contradiction with what was said by Ibbs & Kwak (2000) that found that project managers pay most attention to cost and communications areas. This might induce the conclusion that managers tend to give more attention to areas with a strong link to costs, such as cost and procurement, and neglect others with a weaker direct relation, like communications.

Quality management was aligned with the importance given by the literature. Being part of the “quadruple constraint” (Schwalbe, 2012), it was holding the 3rd position for degree of knowledge, 6th for degree of importance and 4th for the degree of application.

Human resources area, which was considered as critical for project success by Cooke-Davies (2002) also held a stable position of 4th, 5th and 3rd for degree of knowledge, importance and application respectively. Despite the lack of knowledge on project management practices, this area looks to be implicit to the business, thus being better known and applied.

Another area which was considered as critical for project success by Cooke-Davies (2002) was risk management. However, according to Schwalbe (2012) risk management practices are applied less, as risk management is “frequently over-looked”, perhaps in part because project managers may tend to avoid thinking about what could go wrong in a project. This trend was verified in the responses from the SME managers, with risk management holding 6th in the degree of knowledge and 7th for importance and application.

Such as with what happened with human resources management, stakeholder management scored better on the degree of application than on the degree of knowledge and importance. According to what was concluded regarding human resources knowledge, this may happen because managers learn stakeholder management organically with the business activity.

With the intent to understand which variables had the most influence on the self-assessed values of knowledge, importance and application, three linear regression models were created. From the age of the respondent, his education degree, his experience in management, the number of projects running at the company, and the number of employees of the company, only the number of running project and the respondents age shown to be statistically significant.

The degree of knowledge and application were positively influenced by the number of running projects and the respondents age while only the number of running projects shown a positive correlation to the importance given to project management practices. In the models where the number of running projects and the respondents age were included, the number of running projects had a much bigger influence in the dependent variable than the respondents age. However the adjusted R square of the models was low, the fact that the number of running projects was statistically significant to be included in the three models and had the biggest correlation to the dependent variable denotes the importance of running projects to understand the importance of project management practices, and increase the knowledge and application.

The results from the multiple linear regression models created also provide great insights to define the training guidelines for the SME community, since they proved that the SMEs managers under study learn mainly by doing, this leads to suggest a more kinesthetic training style.

In order to understand if there was a significant difference in the value of degree of knowledge, importance and application of project management practices, a comparison of means was held by company size. Even though the boxplot shown that medium companies responded with higher values, the difference of means was not statistically significant. Thus, there was no need to conduct further

analysis by company size, since the training guidelines may be applied for both small and medium companies.

5. Conclusions

This research intended to contribute both to the scientific community and to the community of Lourinhã, not only by providing a literature review over the topic of project management on SMEs, but also by providing training guidelines for the local community to foster SME's growth and thus the region development. This dissertation systematic will be made available on the public repositories and the training guidelines provided to *Município da Lourinhã*, who supported this research with the intent to benefit from its results.

Regarding the bibliometric literature review held, it was noticeable the shortage of studies regarding project management under the SME domain, being even more noticeable the inexistence of studies sorting knowledge areas by importance conducted within SMEs scope. From the 4 search queries created only 2 returned results, resulting in 191 documents published since 2012, from which only 17 were considered relevant for this study. The fact that only 2 of 4 search queries returned relevant results and the low number of documents evidenced the research gap on project management for SMEs. A chronological analysis evidenced that the thematic is recent since studies addressing project management and SMEs had its seminal articles on 1994 with the number of documents starting to rise since 1998 until nowadays. The studies regarding knowledge areas sorting shown to be even more recent, with its seminal article on 2009 and the number of publications rising only since 2015.

The co-authorship analyses shown that cooperation is not happening between investigation teams, returning a high number of clusters while compared with the number of authors under study. This may be justified by the authors working in specific niches, as this is a recent and understudied topic and many studies focused on specific industries and geographical areas. Regarding the terms co-occurrence analysis held, from the 4 clusters in which terms were organized, one clearly addressed the gap about project management in the literature for SMEs. The proximity of important terms anticipated what was written in the systematic literature review regarding SMEs being important agents of innovation and change, and about the important role of the manager to the SME. Such terms include project manager, SME, innovation and change. The overlay visualizations reinforced the idea that SME related words are in general more recent than project management related ones.

Resulting from the systematic literature review, many definitions of SME were found. For this research, only the threshold of number of employees was considered to classify companies by size, being considered as SME any company with 10 to 250 employees. It is important to note that only 8,8% of the companies that meet the threshold of computing stuff also meet the minimum turnover limit

criterion presented by the European Commission (2008). Thus, the companies of Lourinhã Municipality are small when compared with the figures provided by European Commission.

It is widely recognized in the literature the importance of SMEs to the economy, through employment, innovation and growth, as promoters of entrepreneurial spirit and competitiveness (European Commission, 2008; Floyd & McManus, 2005). It is also recognized the importance of SME projects for the economy, as projects account on average for one third of the turnover of SMEs, and thus projects in SMEs account for almost one fifth of the economy (Turner et al., 2009). However, even not having such an impact in the economy, large infrastructure projects receive far more attention (Hertogh et al., 2008). Not only studies generally scope bigger projects, but also most of the project management standards were primarily designed to manage large projects and cannot be fully applied to project management in SMEs (Marcelino-Sádaba et al., 2014), which undertake smaller projects. Project management procedures for medium-sized projects have been developed (Andersen et al., 2009; TSO, 2017; R. Turner, 2009). They are more tailorable however still to bureaucratic for small projects. Ledwith (2004) and Murphy & Ledwith (2007) have identified that SMEs should follow a structured process for selecting their project management practices, however due to SMEs characteristics, knowing them and following a structured process for selecting project management practices is not enough. The community of researchers and practitioners must work to define appropriate guidelines for SME projects.

Being the person of the manager a key player both for the SME and in project management, their profiles were also addressed in the literature review. Studies revealed the key role of the project manager for the project success, since studies states that the project manager can contribute to project success by 34–47% (Toney, 2002). On the other hand, regarding SME managers studies reveal that they are not only the key person to the company, but they perceive the company as an extension of his personality (Alami & Koubaa, 2018). The definition and skillsets required by the project manager were already defined by the main project management standards, however content regarding SME manager's profile were only found on preceding paper, evidencing the gap in the research on this field. After reviewing both Project Manager and SME manager profiles, can be concluded that the nature of both is significantly different. The project manager acts as an agent who keeps the cycle of planning, delegating, monitoring, and controlling running in order to achieve the strategic goals; contradictory, the SME manager is the one who actually sets the strategic goals, generate innovative responses and respond to economic cycles in order to keep the company running and growing. Naturally, both profiles differ in definition and skillsets.

Studies already addressed the need of applying standards which can benefit the organizations with an improvement in productivity (McHugh and Hogan, 2011; Cleland, 1984), effectiveness (Shenhar et al., 2001), efficiency (Stimpson, 2008), and performance (Abbasi and Al-Mharmah, 2000), benefiting from lower costs and a shortened development times after applying a relevant project management system (Kerzner, 2013). It was defended by Pollack & Adler (2016) that SMES should investment in project management over other disciplines, to increase productivity and sales, since project management skills were shown to have the strongest positive correlation to total sales and greater impact on productivity while compared with other disciplines in which SMES invest more.

As referred by Papke-Shields et al. (2010: 1) “the spread of these standards demonstrates evidence of worldwide growth in awareness and acceptance of the need for formal PM methods”, however project management has long been considered a close to practice discipline (Söderlund & Maylor, 2012) and existing standards look not to fit SMEs being too bureaucratic and having too formalistic structures (Hertogh et al., 2010). Turner et al. (2010, 2012) showed European SMEs need to adopt more informal, less bureaucratic, more people focused project management practices than those adopted by larger organizations on larger projects. Thus, they may need different versions depending on the size of the project (medium, small, or micro), rising the need for greater formality as the firm grows. It is also important to note that smaller companies do not employ specialist project managers and projects are managed by people with other primary roles, whose time and money to invest in training is a constraint (Brettel et al., 2010; Masurel & Van Montfort, 2006; Turner & Ledwith, 2018). However project management has been identified as a valuable skill for SMEs (Turner et al., 2012), simplified project planning and control system, with simplified reporting systems is expected (Turner, 2009).

Although the use of ten knowledge areas by PMI were deprecated, they were used in this research for the sake of finding previous research and being able to compare them with results from the empirical research. According to Zwikael (2009), due to time constraints the project managers may choose to perform those processes that they are most familiar with or that are easier. Thus the author refers that PMI should identify the relative importance of each knowledge area. Research was conducted to understand the relative importance of each knowledge areas. As the most important ones, the triple constraint or “iron triangle” was referenced, namely time, budget, and scope (Atkinson, 1999), along with the “quadruple constraint”, which includes quality (Schwalbe, 2012). PMI (2013) also suggests these four constraints plus risk and resources as the main ones. Other studies referred different knowledge areas (Cooke-Davies, 2002; Demeulemeester & Herroelen, 2002; Ibbs & Kwak, 2000; Y-T Leung & Anderson, 2004), without reaching a condense. The divergence of results could be

justified by high differences existing among various industries (Müller & Turner, 2007a, 2001, 2007b) and/or regions (Nguyen et al., 2017).

No study to sort project management knowledge areas by importance was found for SMEs; however, four studies were found under the general domain which studied: how project management practices are linked to project success, sorting KAs by degree of practice (Papke-Shields et al., 2010); the importance of each KA by calculating the impact of their related planning processes to the project success, sorting KAs by extent of use and importance (Zwikael, 2009); the degree of importance, adoption, and the perceived maturity of each KA, sorting KAs by importance, adoption and perceived maturity (Rasid et al., 2014); and the relation between extent of use and teaching priority of each KA, sorting KAs by extent of use and teaching priority (Nguyen et al., 2017). These studies created a base to understand the importance of each KA, to compare results from the literature with the ones resulting from the empirical research, and thus to understand the direction to go in order to provide tailored training for the community under study. As a result from analyzing each of the studies, could be concluded that there is a tendency to have the golden triangle scoring the best, with at least one of the KAs in the top three on each study. Besides that, the results from the different studies do not converge.

From the empirical research was concluded that SME managers evaluated the degree of importance had the highest value followed by the degree of knowledge and application. This suggests that, by recognizing the importance of project management and by acknowledging the lower degree of knowledge and application of such practices, SME managers may be available to learn and further apply such practices. It was also clear the nescience regarding the thematic, both by the answer provided on textual fields and by the way the knowledge areas were sorted. Thus, it is important that the training to be provided is of introductory level. The fact that the degree of application scored the lower while compared with knowledge and importance by one side evidenced the lack of knowledge, but also highlighted the fact that project management is perceived as too bureaucratic for SMEs. Thus, the training provided should focus on simple guidelines or frameworks, or even on simple concepts or project management mindsets. Examples are the principles provided on the foundation level of Prince2 (TSO, 2017), the values and principles of The Agile Manifesto (Beck et al., 2001), or to briefly present the knowledge areas presented by the PMI (PMI, 2013), however evidence where present on the literature review that this methodology do not fit the size and needs of SMEs.

The knowledge areas presented by PMI were de foundation for the empirical research of this study.

The fact that scope and time management are two of the topmost knowledge areas, and their self-assessed values of degrees of knowledge, importance and application were much lower than expected evidenced the huge need to provide project management training in order to provide this companies with opportunity of growth throw project.

The fact that cost and procurement where the ones rating the highest while others not so directly related to costs such as communication management shown that there is a focus on cost management. This reinforces the idea of the necessity presenting project management as a way to indirectly achieving growth by investment.

Differently of what occurred with other knowledge areas, human resources and stakeholder management shown to be better evaluated in degree of application that knowledge and practice while compared with the other knowledge areas. Perhaps this phenomenon occurs because managers learn these topics organically with the business as usual.

The multiple linear regression models created also evidenced that the number of projects running at the company have the greatest impact on the degrees of knowledge, importance and application of project management practices. Along with the previous conclusions, this provided a great insight on how to drive the project management training.

At first, the community of SME managers shown to have better performance and give more importance to areas they apply the most on their daily activity; secondly the number of projects running at the company had the greatest positive influence on the degree of knowledge, importance, and application of project management practices.

Being so, to increase the usage of project management tools and techniques, the local community of SMEs would benefit from introductory level workshops about simple guidelines, main concepts and the mindset embedded in the project management. However, in order to fit SME manager's kinesthetic learning style of learning by experience, would be of great added value the creation of a support infrastructure for project management where the SME managers could be prompt to drive projects, where they could get advice and be guided on the best practices. Such as Startup Lourinhã exists to incubate new entrepreneurial ideas, a similar entity would be of great value for already existing companies which may benefit from growth throw projects.

5.1. Limitations

This study is limited by the geographical scope of the sample, both by the size and the specific characteristics of the companies of region under which the study was held.

The fact that the degree of knowledge, importance and application of each knowledge areas was self-assessed also constitutes a limitation to the study, specially while considering the low degree of knowledge of the respondents regarding project management, which biased the results.

5.2. Future Research

The implementation of the guidelines provided with this study and the measurement of their impact on company's and region's growth would be of great benefit as future research.

Since most studies found during the literature review regarding project management for SMEs were targeting a specific industry or region, it is of greater importance to broaden the study to a more general domain. Thus, it would be of great value to reproduce this study to a bigger geographical regions. From the bigger sample would be possible to come up with more concrete guidelines to foster SME's growth with project management practices. The guidelines would not also be more concrete but also applicable to a bigger set of companies.

6. Reference List

- Abdul Rasid, S. Z., Wan Ismail, W. K., Mohammad, N. H., & Long, C. S. (2014). Assessing Adoption of Project Management Knowledge Areas and Maturity Level: Case Study of a Public Agency in Malaysia. *Journal of Management in Engineering - ASCE*, 30(2), 264–271. [https://doi.org/10.1061/\(ASCE\)ME.1943-5479.0000200](https://doi.org/10.1061/(ASCE)ME.1943-5479.0000200)
- AFNOR. (2003). *Norma FD X 50-117 Management des Risques d'un Project*.
- AIRMIC, Alarm, & IRM. (2002). *A Risk Management Standard*. The Institute of Risk Managers.
- Alam, M., Gale, A., Brown, M., & Kidd, C. (2008). The development and delivery of an industry led project management professional development programme: A case study in project management education and success management. *International Journal of Project Management*, 26(3), 223–237. <https://doi.org/10.1016/j.ijproman.2007.12.005>
- Alami, F. Z., & Koubaa, S. (2018). *SME Manager Profile & Company Performance: An Exploratory Study*. <https://www.researchgate.net/publication/329982601>
- Andersen, E. S., Grude, K. v, & Haug, T. (2009). *Goal Directed Project Management* (4th edition). Kogan Page.
- APM. (2004). *Project risk analysis and management guide*. (2nd edition). APM Publishing Limited.
- Ashleigh, M., Ojiako, U., Chipulu, M., & Wang, J. K. (2012). Critical learning themes in project management education: Implications for blended learning. *International Journal of Project Management*, 30(2), 153–161. <https://doi.org/10.1016/j.ijproman.2011.05.002>
- Atkinson, R. (1999). Project management: cost, time and quality, two best guesses and a phenomenon, its time to accept other success criteria. *International Journal of Project Management*, 17(6), 337–342. [https://doi.org/10.1016/S0263-7863\(98\)00069-6](https://doi.org/10.1016/S0263-7863(98)00069-6)
- Ayyagari, M., Beck, T., & Demircug-Kunt, A. (2007). Small and medium enterprises across the globe. *Small Business Economics*, 29(4), 415–434. <https://doi.org/10.1007/s11187-006-9002-5>
- Beck, K., Beedle, M., Bennekum, A. van, Cockburn, A., Cunningham, W., Fowler, M., Grenning, J., Highsmith, J., Hunt, A., Jeffries, R., Kern, J., Marick, B., Martin, R. C., Mellor, S., Schwaber, K., Sutherland, J., & Thomas, D. (2001). *The Agile Manifesto*. <http://agilemanifesto.org/>

Beck, T., & Levine, R. (2005). SMEs, Growth, and Poverty: Cross-Country Evidence. *Journal of Economic Growth*, 10, 199–229. <https://doi.org/10.1007/s10887-005-3533-5>

Belts, M. (1994). SUSTAINABLE COMPETITIVE ADVANTAGE FOR PROJECT-MANAGEMENT CONSULTANTS. *Journal of Management in Engineering*, 10(1), 43–51. [https://doi.org/10.1061/\(ASCE\)9742-597X\(1994\)10:1\(43\)](https://doi.org/10.1061/(ASCE)9742-597X(1994)10:1(43))

Blackburn, R., & Kovalainen, A. (2009). Researching small firms and entrepreneurship: Past, present and future. *International Journal of Management Reviews*, 11(2), 127–148. <https://doi.org/10.1111/j.1468-2370.2008.00254.x>

Brady, T., & Davies, A. (2014). Managing structural and dynamic complexity: A tale of two projects. *Project Management Journal*, 45(4), 21–38. <https://doi.org/10.1002/pmj.21434>

Brettel, M., Engelen, A., & Voll, L. (2010). Letting Go to Grow—Empirical Findings on a Hearsay. *Journal of Small Business Management*, 48(4), 552–579. <https://doi.org/10.1111/j.1540-627X.2010.00308.x>

Brosseau, L., & Fredrickson, A. (2009). Assessing Outcomes of Industrial Hygiene Graduate Education. *Journal of Occupational and Environmental Hygiene*, 6(5), 257–266. <https://doi.org/10.1080/15459620902754372>

Cicmil, S., & Hodgson, D. (2006). New possibilities for project management theory: a critical engagement. *Project Management Journal*, 37(3), 111–122.

Cooke-Davies, T. (2002). The “real” success factors on projects. *International Journal of Project Management*, 20, 185–190. www.elsevier.com/locate/ijproman

Cooke-Davies, T. (2004). *The Wiley Guide to Managing Projects* (P. W. G. Moris & J. K. Pinto, Eds.; 1st ed.). Wiley.

Cooper, R., & Kleinschmidt, E. J. (1995). Benchmarking the firm's critical success factors in new product development. *Journal of Product Innovation Management*, 12(5), 374–391. <https://doi.org/10.1111/1540-5885.1250374>

Crawford, J. K. (2010). *The Strategic Project Office* (2nd Edition). CRC Press.

Demeulemeester, E. L., & Herroelen, W. S. (2002). *Project Scheduling: A Research Handbook*. Springer.

Diab, P. R. (2011). *Sidestep Complexity: Project Management for Small- And Medium-Sized Organizations*. Project Management Institute.

Directorate-General for Enterprise and Industry, European Commission, & Directorate-General for Internal Market, li. E. and Sme. (2007). *Putting SMEs first: Europe is good for SMEs, SMEs are good for Europe*. Publications Office of the European Union.

Dominguez, C., Varajão, J., Morgado, L., Oliveira, I., & Sousa, F. (2010). SME managers' most important entrepreneurship and business competences. *Communications in Computer and Information Science*, 110 CCIS(PART 2), 274–282. https://doi.org/10.1007/978-3-642-16419-4_28

Escribá-Esteve, A., Sánchez-Peinado, L., & Sánchez-Peinado, E. (2009). The influence of top management teams in the strategic orientation and performance of small and medium-sized enterprises. *British Journal of Management*, 20(4), 581–597. <https://doi.org/10.1111/j.1467-8551.2008.00606.x>

European Commission. (2008). *The New SME Definition: User Guide and Model Declaration* (Enterprise and Industry Publication, Ed.). European Union Publications Office.

Eurostat. (2021). (Online Data Codes: Sbs_sc_ind_r2, Sbs_sc_con_r2, Sbs_sc_dt_r2, Sbs_sc_1b_se_r2). <http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/themes>

Eweje, J., Turner, R., & Müller, R. (2012). Maximizing strategic value from megaprojects: The influence of information-feed on decision-making by the project manager. *International Journal of Project Management*, 30(6), 639–651. <https://doi.org/10.1016/j.ijproman.2012.01.004>

Faber, P. (2000). *La motivation du Dirigeant de PME : un processus à gérer pour soi-même et l'organisation*. Institut d'Administration des Entreprises.

Field, A. (2017). *Discovering Statistics Using IBM SPSS Statistics* (5th Edition). SAGE Publications Ltd.

Floyd, D., & McManus, J. (2005). The role of SMEs in improving the competitive position of the European Union. *European Business Review*, 17(2), 144–150. <https://doi.org/10.1108/09555340510588011>

Flyvbjerg, B. (2014). What you should know about megaprojects and why: An overview. In *Project Management Journal* (Vol. 45, Issue 2, pp. 6–19). <https://doi.org/10.1002/pmj.21409>

Fortune, J., & White, D. (2006). Framing of project critical success factors by a systems model. *International Journal of Project Management*, 24(1), 53–65. <https://doi.org/10.1016/j.ijproman.2005.07.004>

Fossum, K. R., Binder, J. C., Madsen, T. K., Aarseth, W., & Andersen, B. (2019). Success factors in global project management. *International Journal of Managing Projects in Business*, 13(1), 128–152. <https://doi.org/10.1108/IJMPB-09-2018-0182>

Ghobadian, A., & Gallear, D. (1997). TQM and organization size. *International Journal of Operations & Production Management*, 17(2), 121–163.

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). *MULTIVARIATE DATA ANALYSIS EIGHTH EDITION*. www.cengage.com/highered

Hertogh, M., Baker, S., Staal-Ong, P. L., & Westerveld, E. (2008). *Managing large infrastructure projects : research on best practices and lessons learnt in large infrastructure projects in Europe*. AT Osborne BV.

Hertogh, M., Baker, S., Staal-Ong, P. L., & Westerveld, E. (2010). Project management in small to medium-sized enterprises: Matching processes to the nature of the firm. *International Journal of Project Management*, 28(8), 744–755. <https://doi.org/10.1016/j.ijproman.2010.06.005>

Hudson, M., Smart, A., & Bourne, M. (2001). Theory and practice in SME performance measurement systems. *International Journal of Operations and Production Management*, 21(8), 1096–1115. <https://doi.org/10.1108/EUM00000000005587>

Ibbs, C. W., & Kwak, Y. H. (2000). Assessing Project Management Maturity. *Project Management Journal*, 31(1), 32–43. www.ce.berkeley.edu/~ibbs.

IPMA. (2006). *IPMA Competence Baseline for Project Management* (3rd edition).

ISO. (2012). *ISO 21500: 2012(E). Guidance on Project Management*. www.iso.org

ISO. (2021). *ISO 21500:2021(E) Project, programme and portfolio management — Context and concepts*.

Jayawickrama, U., Liu, S. F., Smith, M. H., Akhtar, P., & Al Bashir, M. (2019). Knowledge retention in ERP implementations: the context of UK SMEs. *PRODUCTION PLANNING & CONTROL*, 30(10–12), 1032–1047. <https://doi.org/10.1080/09537287.2019.1582107>

Jayawickrama, U., Liu, S., Hudson Smith, M., Akhtar, P., & Al Bashir, M. (2019). Knowledge retention in ERP implementations: the context of UK SMEs. *Production Planning & Control*, 30(10–12), 1032–1047. <https://doi.org/10.1080/09537287.2019.1582107>

Kerzner, H. (2013). *Project Management: A Systems Approach to Planning, Scheduling, and Controlling* (11th edition). Wiley.

Ledwith, A. (2004). *Management of New Product Development in Small Irish Electronics Firms* [PhD Thesis]. University of Brighton.

Lekhukul, S., & Higgins, R. A. (1994). Senior Design Project: Undergraduate Thesis. *IEEE TRANSACTIONS ON EDUCATION*, 37(2), 203–206. <https://doi.org/10.1109/13.284995>

Ling, F. Y. Y., Low, S. P., Wang, S. Q., & Lim, H. H. (2009). Key project management practices affecting Singaporean firms' project performance in China. *International Journal of Project Management*, 27(1), 59–71. <https://doi.org/10.1016/j.ijproman.2007.10.004>

Marcelino-Sádaba, S., Pérez-Ezcurdia, A., Echeverría Lazcano, A. M., & Villanueva, P. (2014). Project risk management methodology for small firms. *International Journal of Project Management*, 32(2), 327–340. <https://doi.org/https://doi.org/10.1016/j.ijproman.2013.05.009>

Masurel, E., & Van Montfort, K. (2006). Life Cycle Characteristics of Small Professional Service Firms*. *Journal of Small Business Management*, 44(3), 461–473. <https://doi.org/10.1111/j.1540-627X.2006.00182.x>

Mcadam, R., Reid, R. S., & Gibson, D. A. (2004). Innovation and Organisational Size in Irish SMEs: An Empirical Study. *International Journal of Innovation Management*, 8(2), 147–165. www.worldscientific.com

Morris, P. W. G., & Geraldi, J. (2011). Managing the Institutional Context for Projects. *Project Management Journal*, 20–32. <https://doi.org/10.1002/pmj>

Müller, R., & Turner, J. R. (2007a). Matching the project manager's leadership style to project type. *International Journal of Project Management*, 25(1), 21–32. <https://doi.org/10.1016/j.ijproman.2006.04.003>

Müller, R., & Turner, R. (2001). The impact of performance in project management knowledge areas on earned value results in information technology projects. *International Journal of Project Management*, 7(1), 44–51. www.pry.fi/pmaf_mag.htm

Müller, R., & Turner, R. (2007b). The Influence of Project Managers on Project Success Criteria and Project Success by Type of Project. *European Management Journal*, 25(4), 298–309. <https://doi.org/10.1016/j.emj.2007.06.003>

Município da Lourinhã. (2023, August 27). *Site Autárquico do Município da Lourinhã - Localização e Caracterização*.

Murphy, A., & Ledwith, A. (2007). Project management tools and techniques in high-technology SMEs. *Management Research Review*, 30(2), 153–166. <https://doi.org/10.1108/01409170710722973>

Nguyen, L. D., Chih, Y.-Y., & García de Soto, B. (2017). Knowledge Areas Delivered in Project Management Programs: Exploratory Study. *Journal of Management in Engineering - ASCE*, 33(1). [https://doi.org/10.1061/\(ASCE\)ME.1943-5479.0000473](https://doi.org/10.1061/(ASCE)ME.1943-5479.0000473)

OGC. (2007). *Managing Successful Programmes*.

Oukennou, A., El Oumami, M., Beidouri, Z., & Bouksour, O. (2021a). Project Management in Moroccan Companies: Qualitative and Quantitative Approaches. *QUALITY-ACCESS TO SUCCESS*, 22(180), 68–71.

Oukennou, A., El Oumami, M., Beidouri, Z., & Bouksour, O. (2021b). SMEs Project Management in African Context: Moroccan Quantitative Approach. *QUALITY-ACCESS TO SUCCESS*, 22(181), 129–136.

Pant, I., & Baroudi, B. (2008). Project management education: The human skills imperative. *International Journal of Project Management*, 26(2), 124–128. <https://doi.org/10.1016/j.ijproman.2007.05.010>

Papke-Shields, K. E., Beise, C., & Quan, J. (2010). Do project managers practice what they preach, and does it matter to project success? *International Journal of Project Management*, 28(7), 650–662. <https://doi.org/10.1016/j.ijproman.2009.11.002>

Payne, J. H., & Turner, J. R. (1999). Company-wide project management: the planning and control of programmes of projects of different type. *International Journal of Project Management*, 17(1), 55–59.

Perren, L., & Grant, P. (2000). The evolution of management accounting routines in small businesses: A social construction perspective. *Management Accounting Research*, 11(4), 391–411. <https://doi.org/10.1006/mare.2000.0141>

Pinto, J. K., & Slevin, D. P. (1987). Critical Factors in Successful Project Implementation. *IEEE Transactions on Engineering Management*, EM-34(1), 22–27.
<https://doi.org/10.1109/TEM.1987.6498856>

PMI. (2008). *A guide to the project management body of knowledge (PMBOK® Guide) Fourth Edition* (Fourth Edition). Project Management Institute.

PMI. (2013). *A guide to the project management body of knowledge (PMBOK® guide) Fifth Edition* (Fifth edition). Project Management Institute.

PMI. (2021). *A guide to the project management body of knowledge (PMBOK® guide) Seventh Edition*.

Pollack, J., & Adler, D. (2014). Does Project Management Affect Business Productivity? Evidence from Australian Small to Medium Enterprises. *Project Management Journal*, 45(6), 17–24. <https://doi.org/10.1002/pmj.21459>

Pollack, J., & Adler, D. (2016). Skills that improve profitability: The relationship between project management, IT skills, and small to medium enterprise profitability. *International Journal of Project Management*, 34(5), 831–838.
<https://doi.org/https://doi.org/10.1016/j.ijproman.2016.03.004>

PricewaterhouseCoopers. (2007). *Insights and Trends: Current Programme and Project Management Practices**. <https://www.pwc.com/cl/es/publicaciones/assets/insighttrends.pdf>

sabi. (2023). <https://sabi.bvdinfo.com/>

Sane, S. (2020). Effect of using project management tools and techniques on SMEs performance in developing country context. *International Journal of Managing Projects in Business*, 13(3), 453–466. <https://doi.org/10.1108/IJMPB-11-2018-0251>

Schoenherr, T., Hilpert, D., Soni, A. K., Venkataramanan, M. A., & Mabert, V. A. (2010). Enterprise systems complexity and its antecedents: A grounded-theory approach. *International Journal of Operations and Production Management*, 30(6), 639–668.
<https://doi.org/10.1108/01443571011046058>

Schwalbe, K. (2012). *An Introduction to Project Management, Fourth Edition* (4th edition). Kathy Schwalbe, LLC.

Söderlund, J., & Maylor, H. (2012). Project management scholarship: Relevance, impact and five integrative challenges for business and management schools. *International Journal of Project Management*, 30(6), 686–696. <https://doi.org/10.1016/j.ijproman.2012.03.007>

The World Bank (Ed.). (2006). *The Little Data Book 2006: World Development Indicators*.

Thomas, J., & Mengel, T. (2008). Preparing project managers to deal with complexity - Advanced project management education. *International Journal of Project Management*, 26(3), 304–315. <https://doi.org/10.1016/j.ijproman.2008.01.001>

Toney, F. (2002). *The Superior Project Manager - Global Competency Standards and Best Practices* (1st Edition). Marcel Dekker Inc.

Torrès, O. (1999). *Les PME*. Flammarion .

TSO. (2017). *Managing Successful Projects with PRINCE2* ® (2017 edition). The Stationery Office.

Turner, J. R. (2007). *The Gower Handbook of Project Management* (J. R. Turner, Ed.; 4th edition). Ashgate.

Turner, R. (2009). *The Handbook of Project-based Management: Leading Strategic Change in Organizations* (3rd edition). McGraw-Hill.

Turner, R., Eweje, J., & Müller, R. (2012). Project management in small to medium-sized enterprises: Tailoring the practices to the size of company. *Management Decision*, 50(5), 942–957. <https://doi.org/10.1108/00251741211227627>

Turner, R., Huemann, M., Anbari, F. T., & Bredillet, C. N. (2010). *Perspectives on Projects* (1st Edition). Routledge.

Turner, R., & Ledwith, A. (2018). Project Management in Small to Medium-Sized Enterprises: Fitting the Practices to the Needs of the Firm to Deliver Benefit. *Journal of Small Business Management*, 56(3), 475–493. <https://doi.org/10.1111/jsbm.12265>

Turner, R., Ledwith, A., & Kelly, J. (2009). Project management in small to medium-sized enterprises: A comparison between firms by size and industry. *International Journal of Managing Projects in Business*, 2(2), 282–296. <https://doi.org/10.1108/17538370910949301>

Turner, R., Ledwith, A., & Kelly, J. (2010). Project management in small to medium-sized enterprises: Matching processes to the nature of the firm. *International Journal of Project Management*, 28(8), 744–755. <https://doi.org/10.1016/j.ijproman.2010.06.005>

Varajão, J., Colomo-Palacios, R., & Silva, H. (2017). ISO 21500:2012 and PMBoK 5 processes in information systems project management. *Computer Standards & Interfaces*, 50, 216–222. <https://doi.org/https://doi.org/10.1016/j.csi.2016.09.007>

Velegrakis, G., Varajão, J., Morgado, L., Dominguez, C., Rodrigues, C., Coelho, D., Haidimoschi, A., Sancin, C., Doppler, G., Koivusalo, H., & Lakanen, E. (2010). SME managers' required entrepreneurship and business competences. In *E-Business Managerial Aspects, Solutions and Case Studies* (pp. 42–49). IGI Global. <https://doi.org/10.4018/978-1-60960-463-9.ch003>

Winch, G. M. (2013). Escalation in major projects: Lessons from the Channel Fixed Link. *International Journal of Project Management*, 31(5), 724–734. <https://doi.org/10.1016/j.ijproman.2013.01.012>

Y-T Leung, J., & Anderson, J. H. (2004). *Handbook of Scheduling: Algorithms, Models, and Performance Analysis* (1st Edition). Chapman and Hall/CRC.

Zuzek, T., Gosar, Z., Kusar, J., & Berlec, T. (2020). Adopting Agile Project Management Practices in Non-Software SMEs: A Case Study of a Slovenian Medium-Sized Manufacturing Company. *SUSTAINABILITY*, 12(21). <https://doi.org/10.3390/su12219245>

Zuzek, T., Gosar, Z., Kusar, J., & Berlec, T. (2021). A New Product Development Model for SMEs: Introducing Agility to the Plan-Driven Concurrent Product Development Approach. *SUSTAINABILITY*, 13(21). <https://doi.org/10.3390/su132112159>

Zwikael, O. (2009). The Relative Importance of the PMBOK® Guide's Nine Knowledge Areas during Project Planning. *Project Management Journal*, 40(4), 94–103. <https://doi.org/10.1002/pmj.20116>

Zwikael, O., & Globerson, S. (2004). Evaluating the quality of project planning: A model and field results. *International Journal of Production Research*, 42(8), 1545–1556. <https://doi.org/10.1080/00207540310001639955>

Appendix A- Article selection process per search Query

As explained in section 3.2.1 Articles selection, four search queries were created to produce the literature review from this study. Find in the referenced chapter the search keywords and the search queries used. In this appendix the article selection process will be presented per each query.

A.1. Query 1

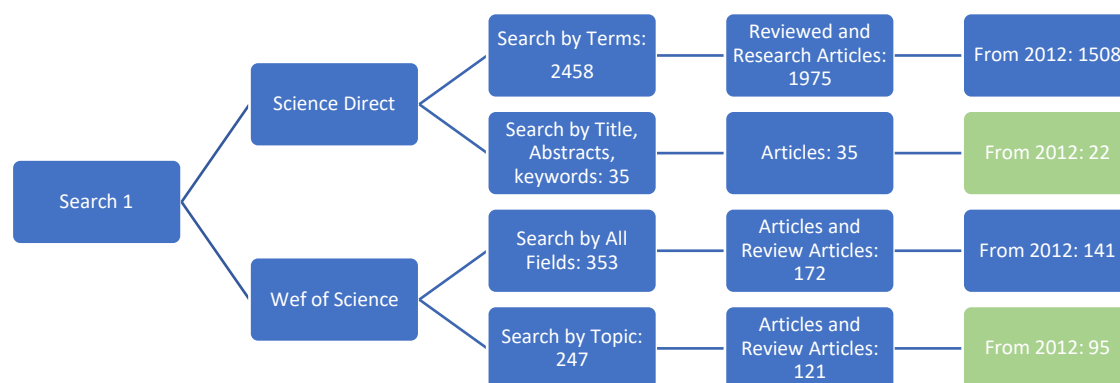


Figure 13. Selection and filtering of results from the search 1

From the first search were considered the search by Title, Abstract and Keyword (TAK) on Science Direct and by Topic on Web of Science. This decision was taken because this type of search returns the most relevant documents, and the number of results was satisfactory: 35 and 247 respectively. After filtering only Articles and Review Articles 22 were returned from Science Direct and 95 from Web of Science (Figure 13). From a total of 117 articles, 12 were considered relevant after reading their abstracts and conclusions.

A.2. Query 2

From the second search were considered results from search by Terms on Science Direct, returning 21 documents, and by All Fields from Web of Science. Those returned 1 article, published since 2012. After reading the articles, it was not found relevant. Two new searches were conducted, for the SME manager profile and for the project manager profile separately, with no relevant results returned.

Therefore, to define the project manager profile the two most-known project management methodologies were consulted (PMI, 2013; TSO, 2017) and to define the SME manager profile a google search was conducted. The google search returned 3 conference papers which, in the absence of peer-reviewed articles, were used to the study (Alami & Koubaa, 2018; Dominguez et al., 2010; Velegrakis et al., 2010).

A.3. Query 3

The third search returned a total of 1 article while searching by Title, Abstract and keywords in Science Direct and 1 article while using any type of search on Web of Science.

Using search by Terms in Science Direct returned 46 Reviewed and Research Articles published since 2012. The Search by Topic returned 1 Proceeding Paper in Web of Science. From the total of 47 documents, none was relevant to the study.

Since no result was found relevant, a fourth search query was created with the intent to find studies addressing knowledge areas ordination. In the created search query the SME concept felt off, being the search conducted considering only project management knowledge areas importance, without being constrained by research conducted under SMEs scope.

A.4. Query 4

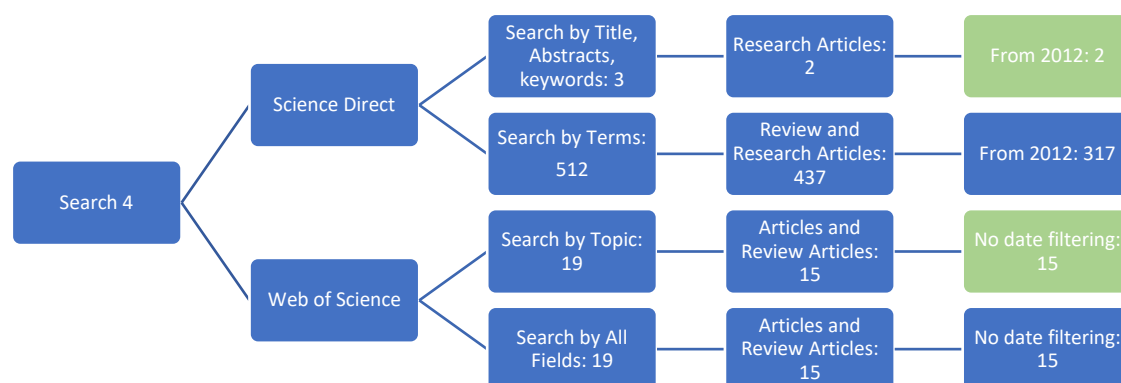


Figure 14. Selection and filtering of results from the search 4

From the fourth search were considered the search by Title, Abstract and keyword on Science Direct and by Topic on Web of Science. This decision was taken because this type of search returns the most relevant documents, and the number of results was satisfactory: 3 and 19 respectively. After filtering only Articles, Review Articles and Research articles, 2 were returned from Science Direct and 15 from Web of Science (Figure 14). From a total of 17 articles, 5 were considered relevant after reading their abstracts and conclusions.

Appendix B- Quartile table and information sources

In this appendix the origin of the seventeen articles used for the literature review will be presented. Derived from the reference articles from first and fourth searches, other documents were reached. The process of article selection can be found in the section 3.2.1 Articles selection.

B.1. From search 1

Table 49. Journals used from first search.

	Quartile	H-index	SJr	Count
International Journal of Project Management	Q1	153	2.495	7
International Journal of Managing Projects in Business	Q1	153	2.495	1
Journal of Small Business Management	Q1	120	1.361	1
Management Decision	Q1	106	1.155	1
Production Planning & Control	Q1	85	1.661	1
Project Management Journal	Q1	48	1.148	1

* Source: Own authorship

B.2. From search 4

Table 50. Journals used from fourth search.

Journal	Quartile	H-index	SJr	Count
Journal of Management in Engineering - ASCE	Q1	79	1.619	2
International Journal of Project Management	Q1	153	2.495	1
Computer Standards & Interfaces	Q1/Q2	67	0.867	1
Project Management Journal	Q1	48	1.148	1

* Source: Own authorship

Appendix C- Co-authorship Analyses

As presented in 3.2.3 Co-authorship analysis, co-authorship analysis were held to two sets of articles: All the articles returned by the selected search type published since 2012 - relate to Total since 2012 (included) column on Table 14; and the articles selected for the systematic literature review - relate to Selected (Q1/Q2) column on the same table.

In this appendix the results from the co-authorship analysis will be presented per query and for the complete set of documents for the two groups addressed in the paragraph bellow.

C.1. Documents published since 2012

C.1.1. All Searches

At first, a co-authorship analyses was held to the set of documents returned from the 4 searches conducted published since 2012 (Figure 15) - Total since 2012 (included) column on Table 14. Documents with number of authors larger than 25 were ignored and the minimum number of documents of an author was 2, both parameters set by default by the software used - VOSviewer.

31 authors were returned organized in 17 clusters, which reveals that there were multiple teams working on the documents, however the interaction between them was small. The largest cluster had 4 authors.

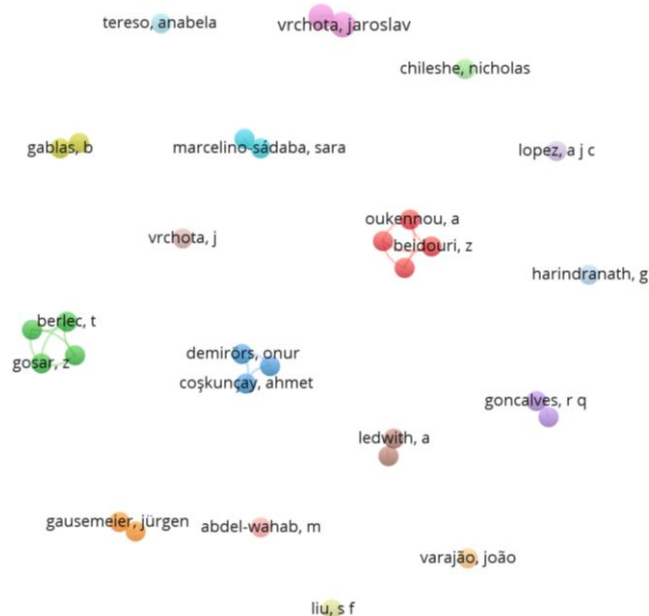


Figure 15. Co-authorship analyses to documents from the selected search type published since 2012

In order to discriminate the most relevant authors from the co-authorship analysis done, a graph was created showing only the authors with total link strength higher then 3 (in this case 4 and 6) (Figure 16). 11 authors in 3 clusters were outputted, supporting the idea of teams not collaborating with each other.

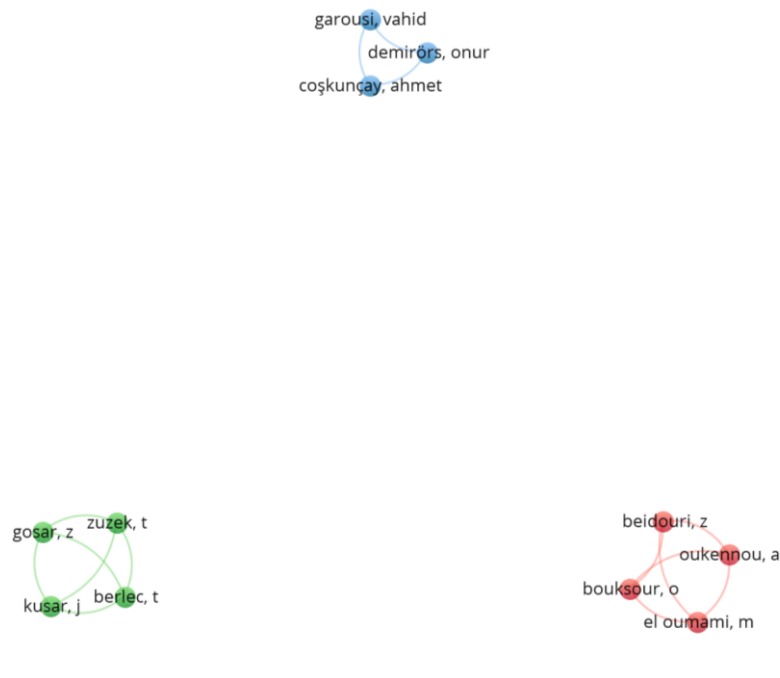


Figure 16. Co-authorship analyses to documents from the selected search type published since 2012 - link strength > 3

C.1.2. Search 1

A co-authorship analyses was undertaken to the results from first search published since 2012 (Figure 17) - Total since 2012 (included) column on Table 14. Documents with number of authors larger than 25 were ignored and the minimum number of documents of an author was 2, both parameters set by default by VOSviewer.

The graph returned showed 17 authors in 8 clusters. The largest cluster had 4 authors.

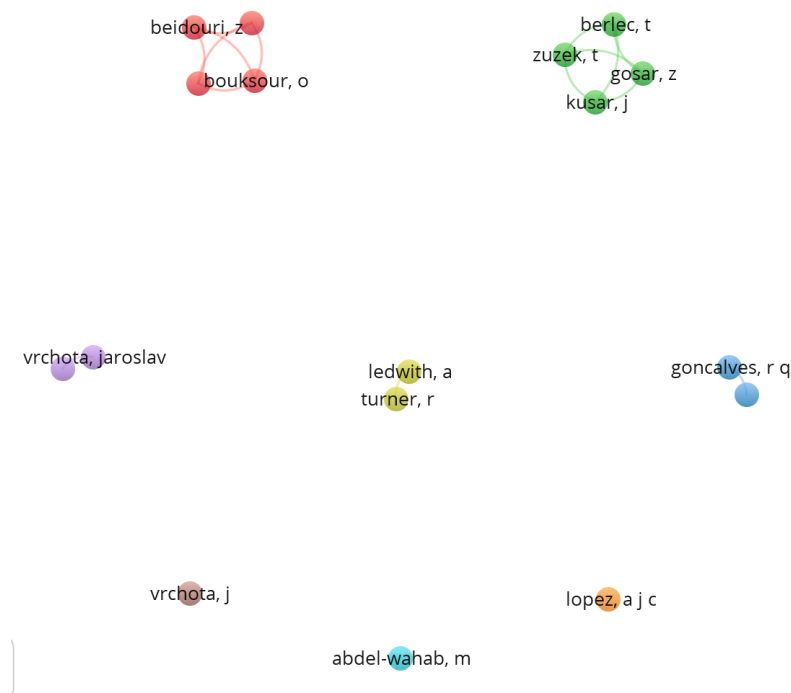


Figure 17. Co-authorship analyses to documents from the selected search type published since 2012 from the first search.

In order to discriminate the most relevant authors from the co-authorship analysis done, a new graph was created (Figure 18) plotting only the authors with total link strength higher than 3, resulting in 2 clusters with a total of 8 authors. In the graph, the red cluster refers to two articles written by four authors (Oukennou et al., 2021b, 2021a), whose main topic is project management on underdeveloped countries. The green cluster also refers to two articles written by other four authors (Zuzek et al., 2020, 2021), studying product development and agile methodologies for SMEs.



Figure 18. Co-authorship analyses to documents from the selected search type published since 2012 from the first search - link strength > 3

C.1.3. Searches 2 and 3

As searches 2 and 3 did not return any relevant document, co-authorship analyses will not be presented in detail. However, they contributed to general conclusions that can be found in the section 3.2.3 Co-authorship analysis of this document.

C.1.4. Search 4

The same analyses were conducted to search 4 for documents published since 2012 (Figure 19) - Total since 2012 (included) column on Table 14. Documents with number of authors larger than 25 were ignored and the minimum number of documents of an author was set to 1 by the software, as the number of documents was considerably small (13 against 105 from search 1).

38 authors were returned, divided in 15 clusters. The largest cluster connected 5 authors, also representing the cluster of authors with link strength higher than 3 (Figure 20). It refers to a single article (Fossum et al., 2019) studying the success factors in global project management, thus not connected with SMEs scope.

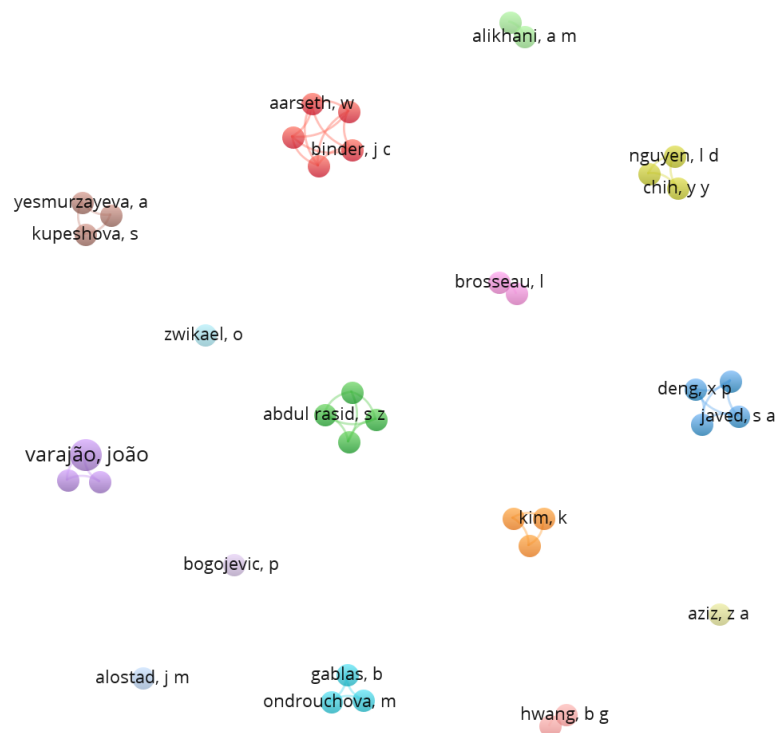


Figure 19. Co-authorship analyses to documents from the selected search type published since 2012 from search 4

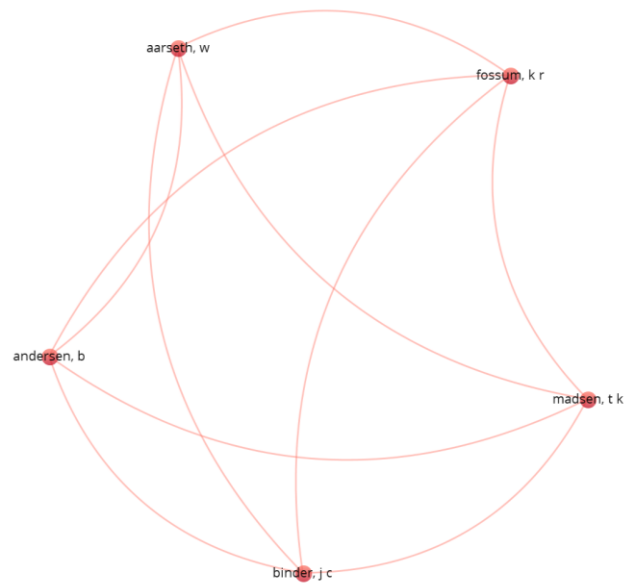


Figure 20. Co-authorship analyses to documents from the selected search type published since 2012 from search 4 - link strength > 3

C.2. Documents used for the systematic literature review

C.2.1. All Searches

At first, a co-authorship analyses was done the total of 17 documents used for the systematic literature review (Figure 15) - relate to *Selected (Q1/Q2)* column on Table 14. Documents with number of authors larger than 25 were ignored, parameter set by default by VOSviewer. However the software was suggesting the minimum number of documents of an author to be 3, the value was set as 1, as due to the low number of documents under study the network would show only 3 authors with the previous value set by the software.

37 authors were returned organized in 13 clusters, which reveals that there were multiple teams working on the documents, however the interaction between them was small. The largest cluster had 5 authors.

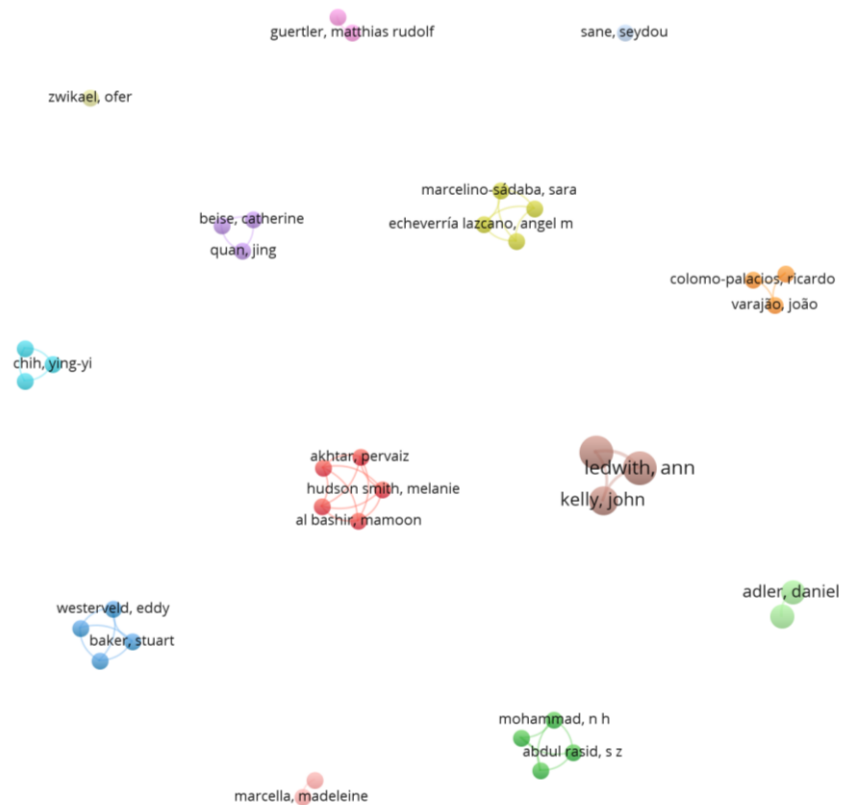


Figure 21. Co-authorship analyses to documents used for the literature review

In order to discriminate the most relevant authors from the co-authorship analysis done, a graph was created showing only the authors with total link strength higher then 3 (in this case 4, 6 and 7) (Figure 16). 8 authors in 2 clusters were outputted, supporting the idea of teams not collaborating with each other.



Figure 22. Co-authorship analyses to documents used for the literature review - link strength < 3

C.2.2. Search 1

A co-authorship Analyses was undertaken to the documents used for the literature review from first search (Figure 17) - relate to *Selected (Q1/Q2)* column on Table 14. Documents with number of authors larger than 25 were ignored, parameter set by default by VOSviewer. However the minimum number of documents of an author was set as 3 by default, it was changed to 1, due to the small amount of documents under study.

The graph returned showed 23 authors in 8 clusters. The largest cluster had 5 authors.

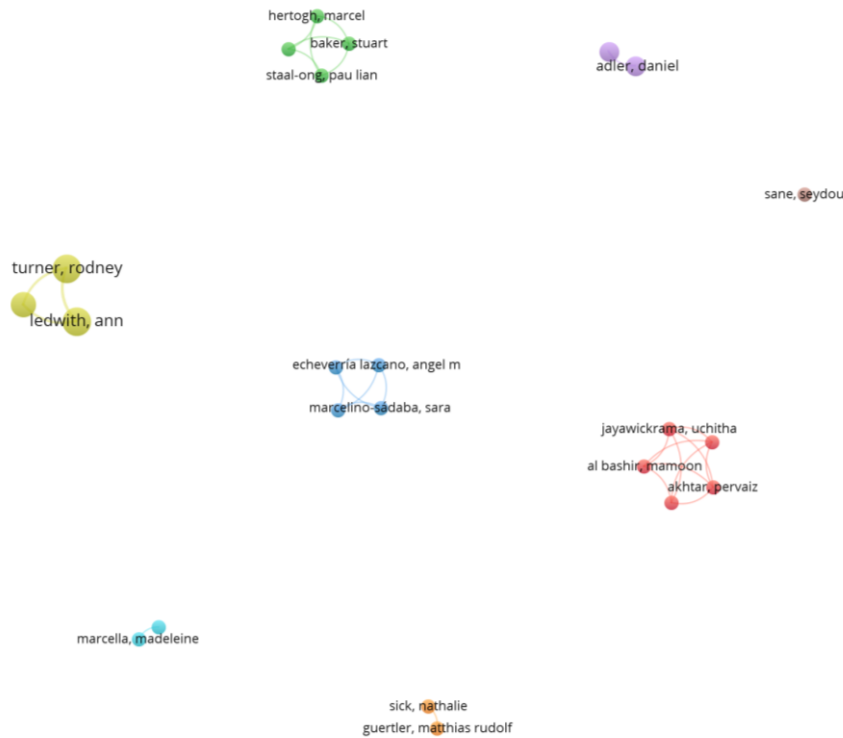


Figure 23. Co-authorship analyses to documents used for the literature review from search 1

In order to discriminate the most relevant authors from the co-authorship analysis done, a new graph was created (Figure 18) showing only the authors with total link strength higher then 3, resulting in 2 clusters with a total of 8 authors. The red cluster referred to one article (Jayawickrama, Liu, Smith, et al., 2019) studying knowledge retention in enterprise resource planning implementation on UK SMEs; and the green one referred to two articles of great value for this research (Turner, Ledwith, et al., 2010; Turner & Ledwith, 2018) regarding fitting the practices of project management in SMEs to the size of the company and to the needs of the firm to deliver value.



Figure 24. Co-authorship analyses to documents used for the literature review from search 1 - link strength > 3

C.2.3. Searches 2 and 3

As searches 2 and 3 did not return any relevant article from Quartile 1 and 2 Journals, none was used for the literature review. Thus, there are no documents to conduct the co-authorship analysis for these searches.

C.2.4. Search 4

The same analyses were conducted to the documents used for the literature review from search 4 (Figure 19) - relate to *Selected (Q1/Q2)* column on Table 14. Documents with number of authors larger than 25 were ignored. However the minimum number of documents of an author was set as 3 by default by the software, it was changed to 1 as the number of documents was considerably small.

14 authors were returned, divided in 5 clusters (Figure 20). The largest cluster connected 4 authors with a single paper (Rasid et al., 2014) which shown to be of great interest for this research, providing an assessment of importance, adoption, and perceived maturity of each knowledge area on a case study of a public agency in Malaysia. No authors had total link strength higher then 3.

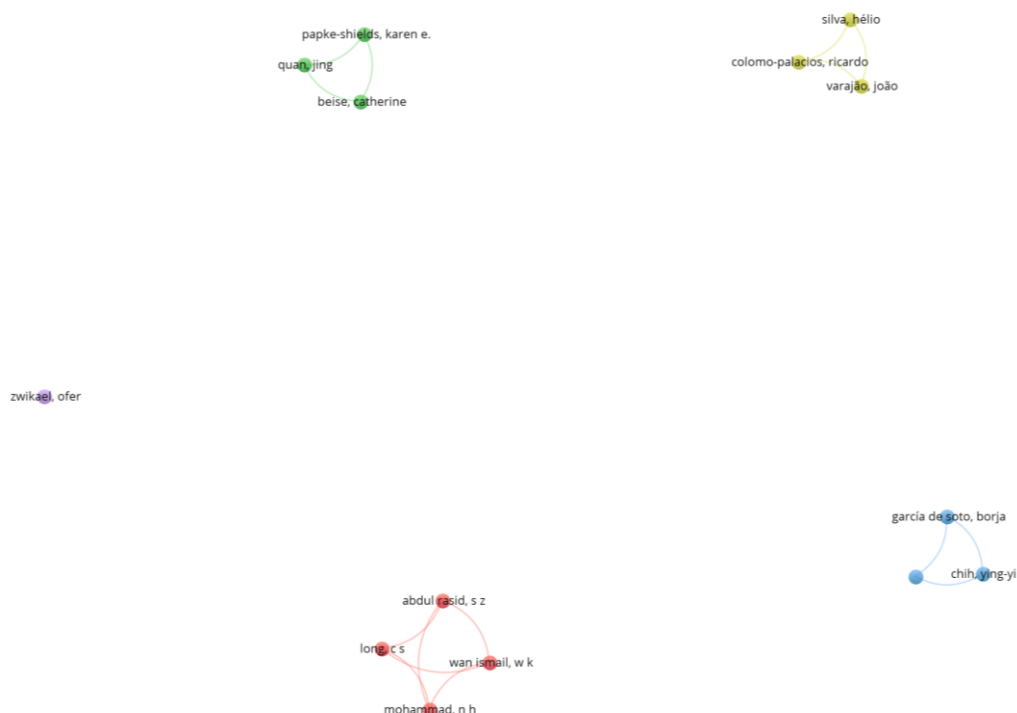


Figure 25. Co-authorship analyses to documents used for the literature review from search 4

Appendix D- Term co-occurrence analysis

A term co-occurrence analysis was held two sets of articles: All the articles returned by the selected search type published since 2012 - relate to Total since 2012 (included) column on Table 14; and the articles selected for the systematic literature review - relate to Selected (Q1/Q2) column on the same table.

The general results of the term co-occurrence analysis are presented on 3.2.4 Term co-occurrence analysis. In this appendix are shown the results per query and for the complete set of documents for the two groups addressed in the paragraph below.

D.1. Documents published since 2012

D.1.1. Search 1

A co-occurrence analyses was held for the documents returned by the first search published since 2012 – Total since 2012 (included) column on Table 14. The default value of minimum of 10 occurrences per word was kept. Of 2205 terms, 25 meet the threshold, from which only 14 terms had a relevance score higher that 60% (Figure 26 and Figure 27). The results were organized in 2 clusters, namely: cluster 1 regarding SMEs, innovation and industry; and cluster 2 regarding SMEs and project management.

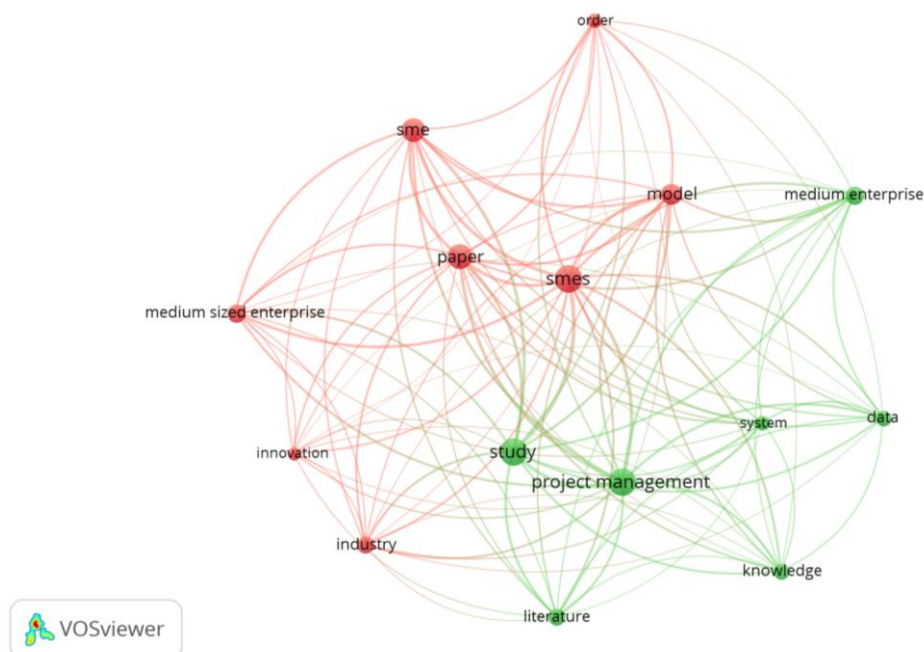


Figure 26. Term co-occurrences analyses to documents from the selected search type published since 2012 from search 1 – network visualization

In the network could be verified that project management is related with SMEs, innovation, knowledge and industry.

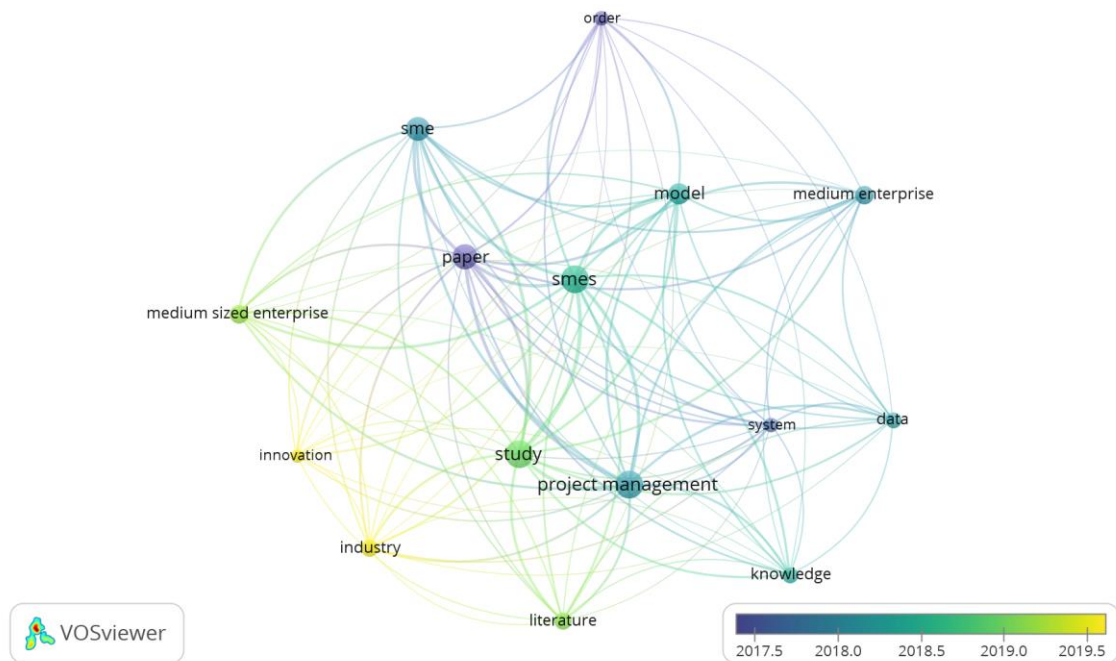


Figure 27. Term co-occurrences analyses to documents from the selected search type published since 2012 from search 1 – overlay visualization

D.1.2. Searches 2 and 3

As the documents returned by the second and third searches were not relevant to the study, results will not be presented in depth, and graphics will be not shown, even though the co-occurrence analysis were conducted.

Using the default VOSviewer settings, search number 2 returned a cloud with only “smes”, “medium sized enterprise” and “study”. As no relevant conclusion could be taken from that result, a new one was conducted considering a minimum 5 occurrences per word. Of 778 terms, 14 meet the threshold, from which only 8 had a score relevance of at least 60%. The results were 2 cluster – one relating project management and SMEs and another relating study with role and impact. With these new settings, was noticed that literature refers to the impact of projects on SMEs. Once again, SME related words were the most recent ones.

The third search was also not conclusive with the default settings from VOSviewer, showing a cloud including only “project”, “research” and “study”. After verifying this result, a new network was created considering a minimum of 5 occurrences per word. Of 1129 terms, 23 meet the threshold and 14 had

a relevance score higher than 60%. "Research" term was removed because it was not relevant, even though it was in the center of the network. The result presented terms organized in 3 clusters – one relating project management with success, another relating practice with role and practitioners, and a third relating analysis, knowledge, data, systems and industry. No relation with SMEs was found, even though it was part of the search query, suggesting that the results were not going to be relevant as concluded while reading the articles.

D.1.3. Search 4

A co-occurrence analysis was held for the documents returned by the fourth search published since 2012 – Total since 2012 (included) column on Table 14. A minimum of 7 occurrences per word was set by default. Of 379 terms, 3 meet the threshold (Figure 28 and Figure 29). The same number had a relevance score higher than 60%. All terms were organized in 1 cluster.

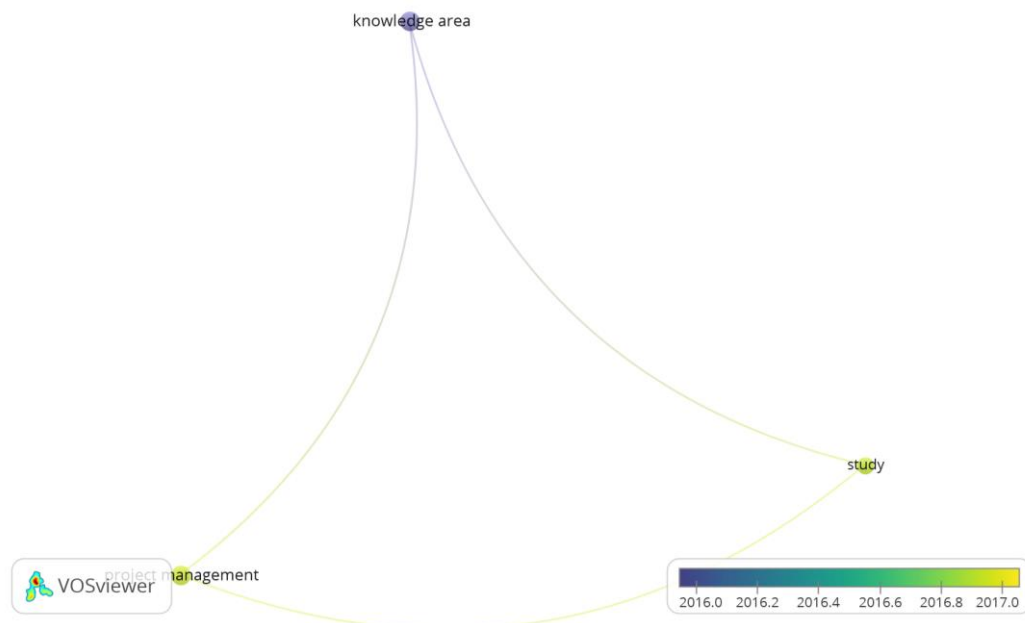


Figure 28. Term co-occurrences analysis to documents from the selected search type published since 2012 from search 4 – overlay visualization

The terms shown in the diagram were the direct result from the search, namely studies about project management knowledge areas.

As a result from the small number of terms being shown in the last network, a new one was created considering a minimum of 5 occurrences per word. Of 379 terms, 7 meet the threshold and 4 has a relevance score higher than 60%. The 4 terms were organized in 1 cluster.

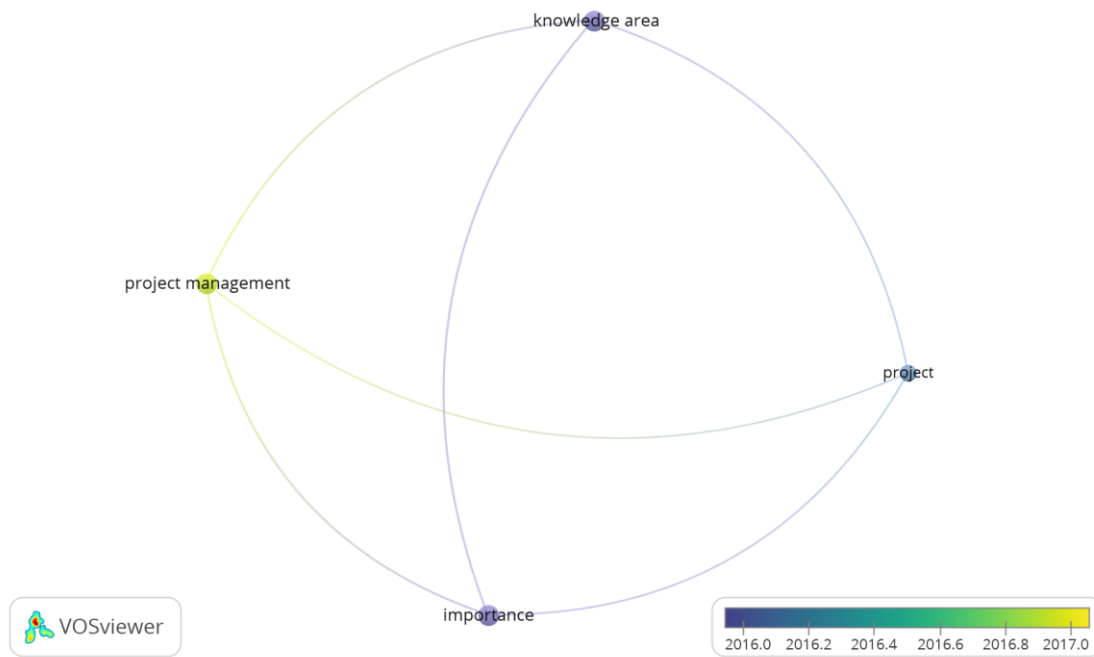


Figure 29. Term co-occurrences analyses to documents from the selected search type published since 2012 from search 4 – overlay visualization

In this network project management, project and knowledge area were linked with importance. This might suggest studies about the importance of the knowledge areas of project management, however as the time associated with each term was different a further reading of the articles must be held to take relevant conclusions about the topic.

D.2. Documents used for the systematic literature review

D.2.1. Search 1

A term co-occurrences analysis was conducted to the documents used for the literature review from search 1 - relate to *Selected (Q1/Q2)* column on Table 14. Due to the low number of documents analyzed, the default value of minimum of 10 occurrences per word was changed to 5. Of 275 terms, 18 meet the threshold, from which only 11 terms had a relevance score higher than 60% (Figure 26 and Figure 27). The results were organized in 2 clusters, namely: cluster 1 regarding Project management, SMEs, person and project; and cluster 2 regarding industry, research and project management tools and techniques.

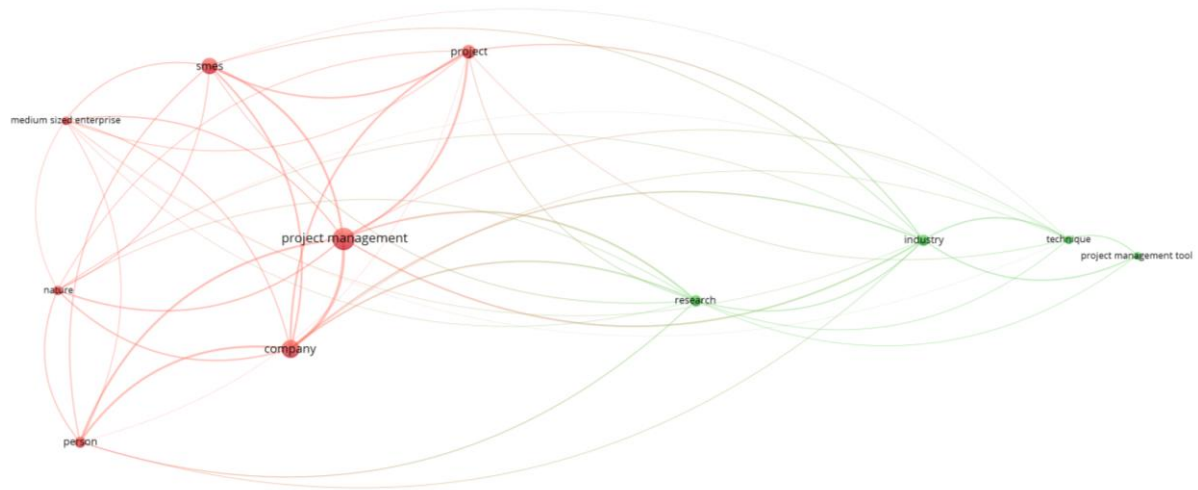


Figure 30. Term co-occurrences analyses to documents used for the literature review from search 1 – network visualization

In the network could be verified the inclusion of the study of the person as an agent for project management on SMEs, since project management procedures for SMEs have a much greater focus on people as social animals (Turner, Ledwith, et al., 2010). It is also visible that research is a point of union from project management for SMEs and project management tools and techniques. Once again, terms related to project management and thus to SMEs shown to be the more recent ones.

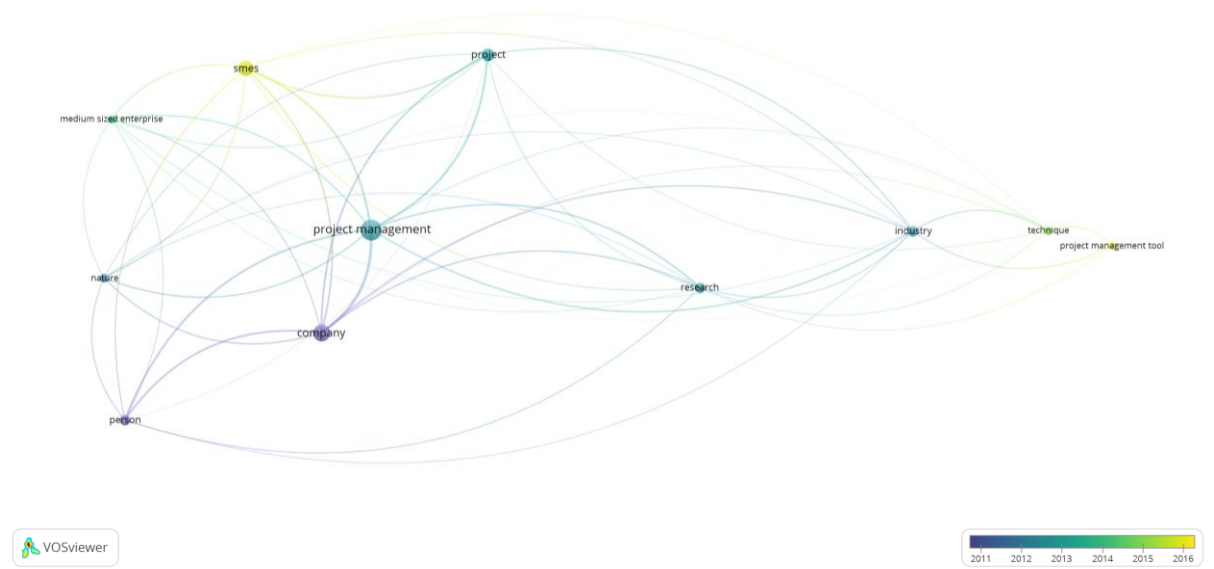


Figure 31. Term co-occurrences analyses to documents used for the literature review from search 1 – overlay visualization

D.2.2. Searches 2 and 3

As searches 2 and 3 did not return any relevant article from Quartile 1 and 2 Journals, none was used for the literature review. Thus, there are no documents to conduct the co-authorship analysis for these searches.

D.2.3. Search 4

The same analyses was conducted to the documents used for the literature review from search 4 - relate to *Selected (Q1/Q2)* column on Table 14. A minimum of 5 occurrences per word was set by default. Of 152 terms, 6 meet the threshold (Figure 28 and Figure 29), from which only 4 terms had a relevance score higher that 60%. All terms were organized in 1 cluster.

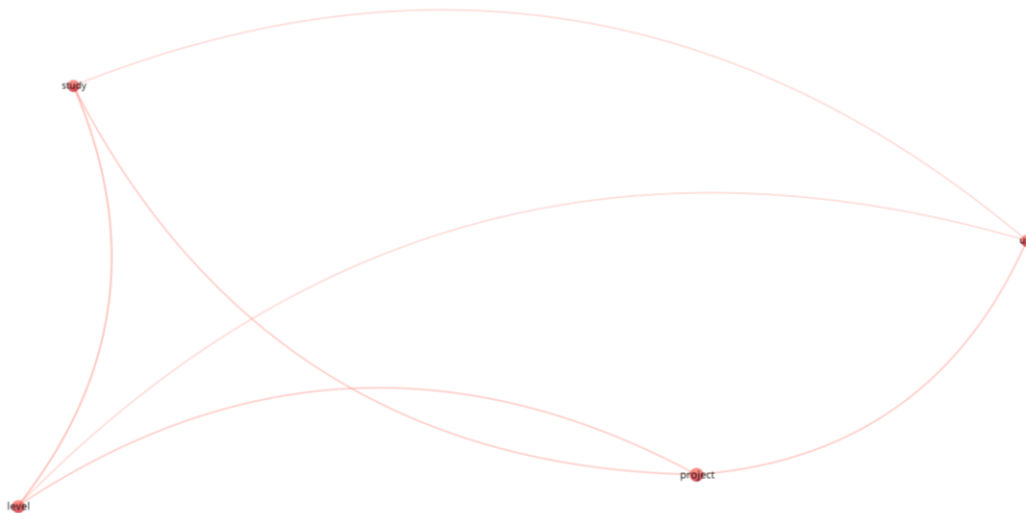


Figure 32. Term co-occurrences analyses to documents used for the literature review from search 4 – overlay visualization

The search intended to find studies regarding project management knowledge areas importance. However, the results from the terms co-occurrences analysis returned no relevant results as the words study, use, level and project were connected, but providing no further context regarding the content and thematic of the studies.

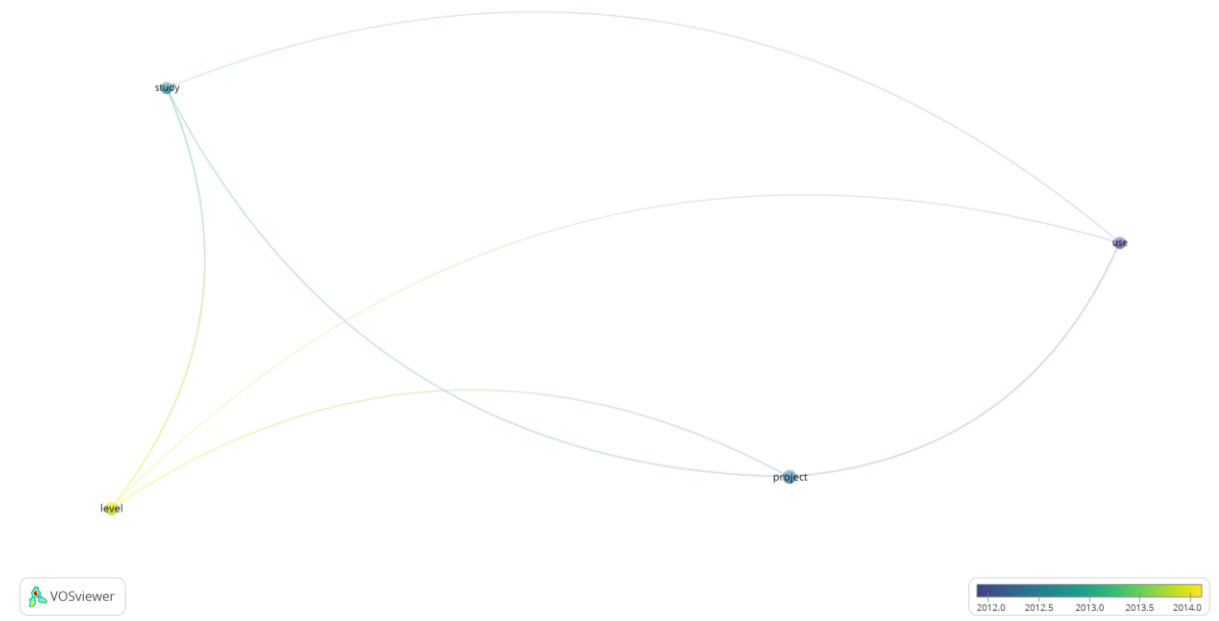


Figure 33. Term co-occurrences analyses to documents used for the literature review from search 4 – overlay visualization

As a result from the small number of terms being shown in the last network, a new one was created considering a minimum of 4 occurrences per word. Of 152 terms, 9 meet the threshold and 5 has a relevance score higher than 60%. The 4 terms were organized in 2 clusters: one including project, level and use; and other including PMBoK and process (Figure 28).

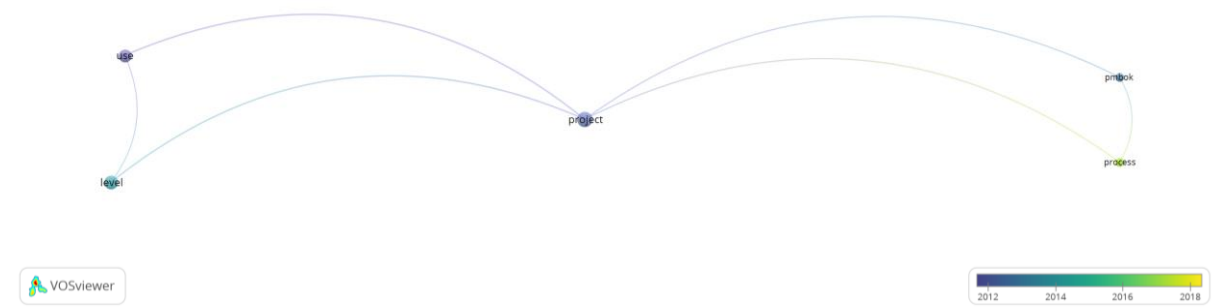


Figure 34. Term co-occurrences analyses to documents used for the literature review from search 4 (min. 4 occurrences) – overlay visualization

In this last network can be seen the usage of PMBOK® Guide as a base for the studies found. However, due to the low number of articles used for this analysis, no further nor more consistent conclusions can be drawn.

Appendix E- Regression standardized residual graphs

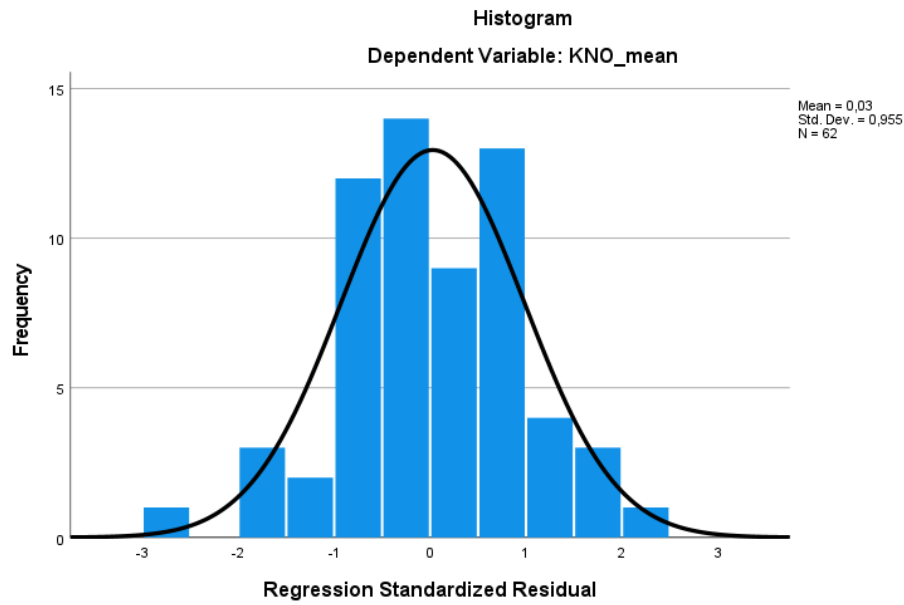


Figure 35. Regression Standardized Residual Histogram, Dependent Variable: KNO_mean

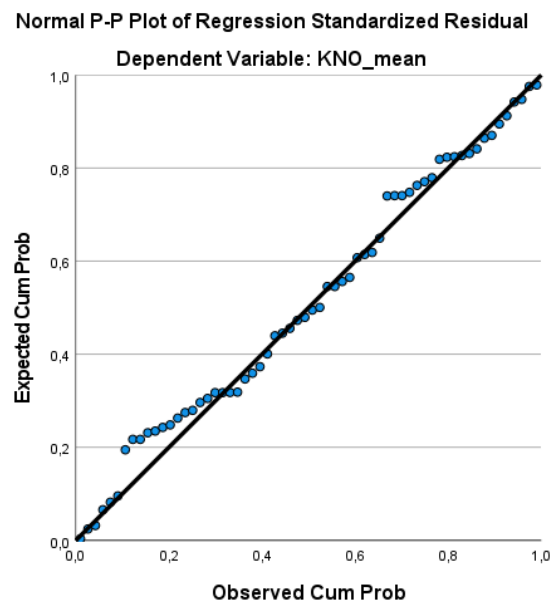


Figure 36. Normal P-P Plot of Regression Standardized Residual, Dependent Variable: KNO_mean

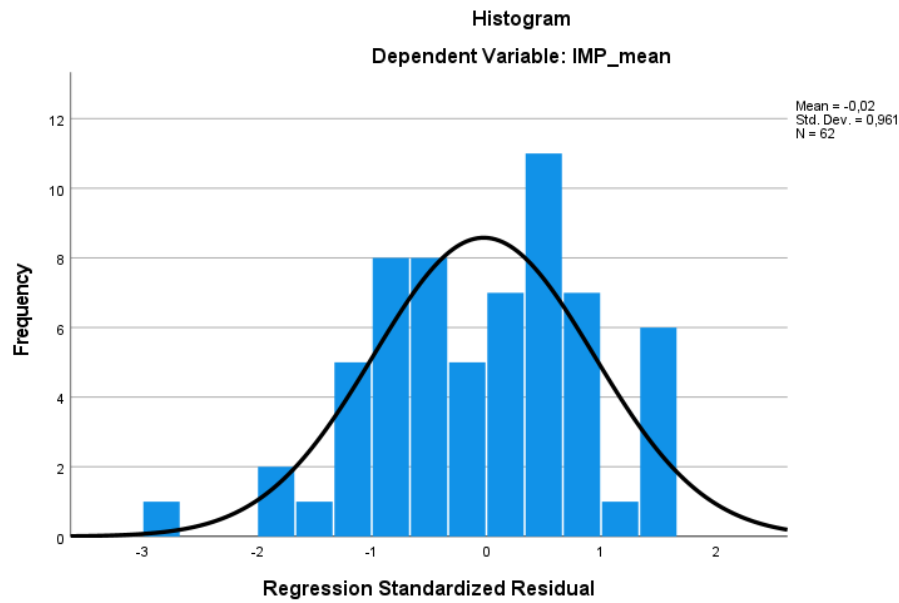


Figure 37. Regression Standardized Residual Histogram, Dependent Variable: IMP_mean

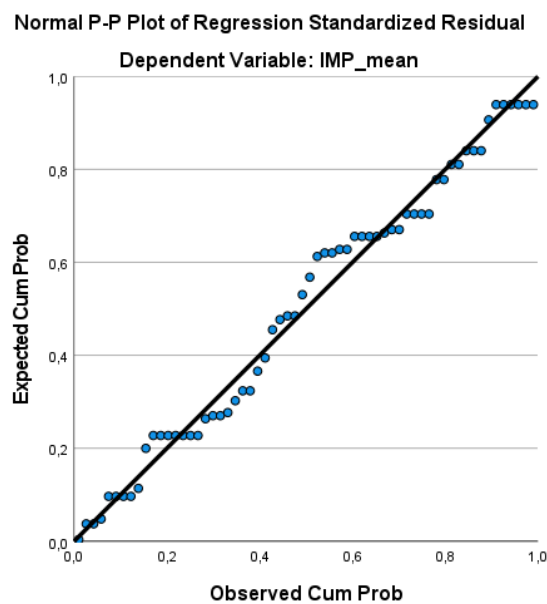


Figure 38. Normal P-P Plot of Regression Standardized Residual, Dependent Variable: IMP_mean

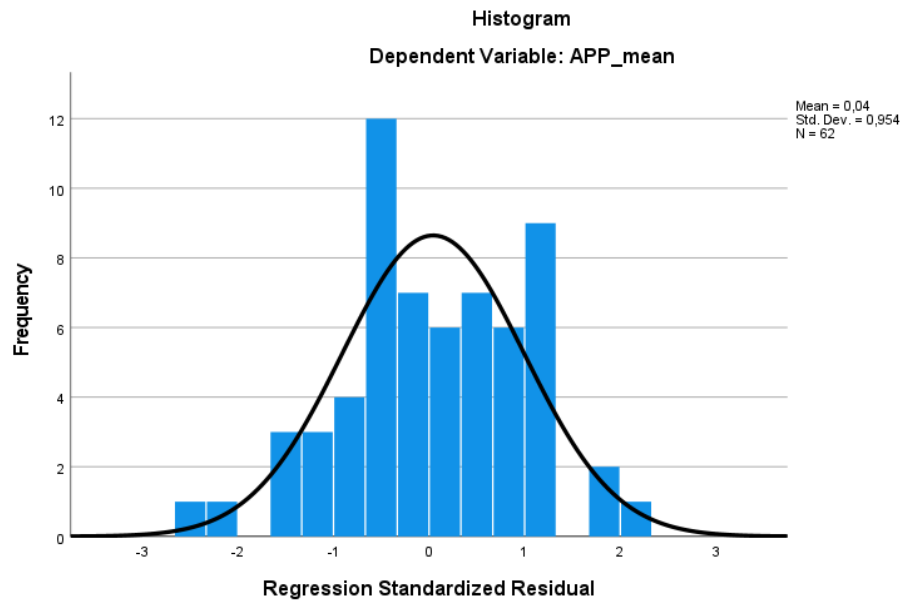


Figure 39. Regression Standardized Residual Histogram, Dependent Variable: APP_mean

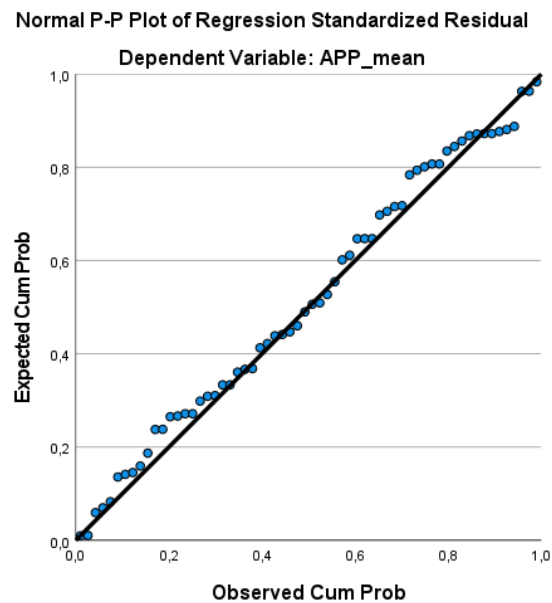
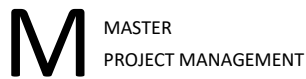


Figure 40. Normal P-P Plot of Regression Standardized Residual, Dependent Variable: APP_mean



Which Project Management Knowledge Areas do SME's Managers value the most in Lourinhã municipality?

Jorge Miguel Santos Fernandes

11/2023

