
Project portfolio management practices – a theoretical base and practitioner guidelines

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Abstract: The collective practices associated with project portfolio management (PPM) are described with different levels of detail in the academic literature. This study provided a consolidated set of PPM practices synthesised from existing PPM literature. A systematic review was followed by a thematic analysis to extract practice domains. The nine practice domains identified are presented together with the management roles associated with portfolio management that can be studied as antecedents of PPM effectiveness. The findings propose a comprehensive list of PPM practice domains, supported by tasks that define the domains as a guideline for practitioners and for future research.

Keywords: project portfolio management; PPM; systematic literature review; strategic project alignment; project management practices.

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1 Introduction

Leaders are increasingly relying on project management in the execution of their strategies, and managers are making sense of multiple investment opportunities by grouping them into projects (Dolci and Maçada, 2011). These projects do not exist in isolation, and neither do the contexts in which they are executed. When organisations mature in their use of project management, they are likely to graduate to project portfolio management (PPM) to deal with the complex interdependency between multiple single projects and their associated contexts (Martinsuo and Geraldi, 2020).

The academic view of PPM is not well-formulated, and the practitioner perspective is not adequately grounded in theory (Killen et al., 2012; Young and Conboy, 2013). PPM practice is thus not sufficiently elucidated in the available academic literature, and

consequently provides limited guidance for practitioners (Hansen et al., 2019; Young and Conboy, 2013). Current PPM practices use practitioner tools and techniques developed by industry bodies. Although these practices are valuable due to their practical nature, relevant management theories could lend more credence and insights into the discipline. Although research has revealed various aspects of the applied practices in project-based management, they have not yet taken a holistic view of the actuality of PPM (Martinsuo, 2013).

PPM is a relatively young discipline with research approaches and standards in the developmental stage (Killen et al., 2012). The practice of PPM in real life is somewhat messier and less rational than some decision-process-centered frameworks would suggest, as acknowledged by some recent empirical studies that drew attention to the day-to-day practice of portfolio management (Martinsuo, 2013).

The objective of this article is to consolidate from the academic literature a set of practices to guide business practitioners in PPM implementation and provide researchers with a consolidated view of the collective practices that constitute PPM.

2 Theoretical base

2.1 Project portfolio management

PPM aims to maximise the contributions of a collective set of projects for the well-being and success of the organisation (Young and Conboy, 2013). Dealing with a portfolio involves uncertainty, with the analysis of all factors that could potentially influence the outcomes being so complicated that they are often not fully comprehensible (Meskendahl, 2010).

Selecting projects is difficult because of the transient nature of project value and the complexity of embedding project outcomes in organisations. Multiple authors have proposed approaches to deal with this complexity, including using goal programming (Lee and Kim, 2000), analytic hierarchy processes (Wei et al., 2005), multi-objective particle swarm optimisation (Rabbani et al., 2010), and multi-criteria utility theory (Stewart and Mohamed, 2002). Suffice it to state that the techniques suggested in academic literature to assist with project selection are probably as complex as the realities faced by the practitioner who has to make these selections based on less structured data.

PPM remains a strategic-level intervention focused on project selection and resourcing – in essence, determining the best value opportunity for the organisation's collective efforts (Pennypacker and Cabanis-Brewin, 2003). Strategic management theory does indeed provide a lens through which to view PPM and its potential to assist in gaining competitive advantage. The strategic challenge to analyse the external environment and increase the advantages over competitors includes prioritising projects (Koh and Crawford, 2012). Managers use PPM as an instrument to garner information (and provide clarity) to help them mould their decisions and actions when adjusting their portfolio of projects to the current context (Biedenbach and Muller, 2012).

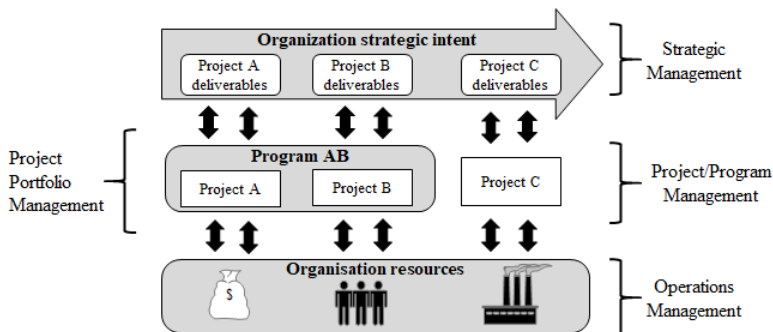
Projects are executed in parallel and compete for scarce resources, and the optimal allocation of resources among concurrent projects is a primary theme in PPM literature (Pajares and López, 2014). PPM is also about choosing the right projects and prioritising projects to enable the prioritisation of project resource allocations (Blichfeldt and Eskerod, 2008). The keywords 'ongoing' and 'continuous' in the definition by Blichfeldt

and Eskerod (2008) indicate that choosing the appropriate projects needs to be supported by the constant re-evaluation of the portfolio. There is an emphasis on the allocation of resources within the project (efficiency), but also on alignment with strategic intent (effectiveness).

2.2 PPM in context

The management of project portfolios is closely related to the strategic management of the organisation. It should assist in driving the execution of strategy via projects, operating in conjunction with the routine activities of the organisation (Nikolova, 2016). Just as projects do not exist in isolation from other projects, so PPM does not exist in isolation from strategic management, project and program management, and operational management (see Figure 1).

Figure 1 Positioning of PPM



Source: Adapted from Munns and Bjeirmi (1996) and Nikolova (2016)

PPM has become an essential component of implementing strategic intent and has a significant influence on the future competitive position of organisations (Gutiérrez and Magnusson, 2014). Labrosse (2010) emphasised the importance of finding the appropriate mix of projects that would help the organisation to achieve its overall strategic goals while finding, as far as possible, the optimum allocation of the organisation's finite resources. PPM entails much more than mere project selection; it includes the setting of project priorities and continuous analysis of the portfolio of projects to determine priorities that assist organisations when assigning limited resources to projects (Patanakul, 2015).

Recent PPM research has begun to focus on the dynamic nature of project portfolios. Researchers have argued that organisations need to continually monitor and control the entire project portfolio (Pajares and López, 2014). The work of Petit (2012) has been instrumental in clarifying how uncertainties affect a portfolio in dynamic environments, making it essential for an organisation to monitor its portfolio consistently.

2.3 Benefits of PPM

Portfolio value maximisation is a complicated endeavour that includes both financial and non-financial metrics. Appropriate implementation of PPM leads to strategic value for

organisations that select their projects in a systemic process (Gutiérrez and Magnusson, 2014) and also terminate poorly performing projects (Rajegopal, 2013).

PPM practices are meant to reduce the risk associated with the execution of an entire portfolio of interdependent projects, since there is a systemic review of dependencies, collaborative resource allocation and a pre-selection investigation of returns for the organisation (Rajegopal, 2013). The risk inherent in the execution of the collective of projects must be reviewed in line with the strategic intent to ensure optimal benefits from the project portfolio (Petit, 2012).

PPM helps organisations to improve cost optimisations during the project life cycle through cost-tracking and visualisation, as well as trend identification across projects in the portfolio. The agility gained by having complete portfolio insights lends organisations an ability to reprioritise resources swiftly based on new information and strategic priorities (Moore, 2010).

Unger et al. (2012) stressed the importance of terminating projects that no longer align with corporate strategy. They introduced the concept of project termination quality and, through a quantitative longitudinal study of a sample of project portfolios, demonstrated that termination quality positively affects strategic fit. Practitioner literature confirms the importance of project termination. Campbell and Park (2004) noted that business leaders often commit towards one or two promising candidates and suffer from an escalation of commitment. This leads to unwavering support for failing projects due to an emotional attachment toward specific projects (Koller et al., 2019).

Resource planning and scheduling have conventionally been done separately for each project. However, there is a clear need to integrate the activities across different projects, as scheduling needs to ensure a pragmatic allocation of the resources (Laslo, 2010). When organisations have an organisation-wide view of the available pool of resources, it becomes easier to manage the resource allocations centrally, as well as to prioritise projects (see Figure 1). Formal resource allocation processes increase the speed of allocation, reduce the conflicts, and improve the reliability of the commitments (Teller et al., 2012).

Measuring benefits beyond financial gains of PPM is important but challenging. Financial measures are easy to obtain and report (Martinsuo and Killen, 2014). Voss (2012) defined some non-financial aspects, such as competence, market leadership and social rewards, as part of a broader view of benefits. A key challenge is that these benefits cannot always be uniquely attributed to a particular project or set of projects.

2.4 PPM practices

Early academic work focused on presenting PPM as a rational decision-making framework (Gutiérrez and Magnusson, 2014). Killen and Hunt (2013) challenged this as overly simplified. They argued that project portfolio decision-making should not use a fixed set of universal criteria for all projects. They posited that non-rational decision-making should be combined with some of the rational decision-making processes. Research also focused on the development of techniques but less on how to implement it in practice. Focus on techniques can lead to a lack of appreciation for the extent to which organisations are using PPM as a management practice. More recent research has explored the understanding of the practical aspects of PPM and addressed the lack of awareness of *practice* and *context* (Martinsuo, 2013).

Gutiérrez and Magnusson (2014) argued that making decisions using only rational and formal approaches might lead to an imbalance between different types of projects and missing business opportunities. Rational and formal decision-making processes are seen as more legitimate than informal and non-rational ones. Decision-makers could experience a fit-for-purpose versus legitimacy problem in applying PPM practices. Managers may emphasise decisions that are defensible as rational and formal, at the expense of the complete set of actions required (Daniel et al., 2014).

Martinsuo (2013, p.799) elaborated on the importance of ‘intuition, negotiation and even bargaining’. She contended that these less formal and defensible attributes of decision making are not present in PPM frameworks built upon rational project portfolio decision making. It is clear from empirical work that decision-making should also consider less-rational factors when guiding the set of practices that defines PPM. Comprehensive PPM practices need to move beyond the alignment and resources allocation arguments that dominate the academic literature.

3 Research design

3.1 Research problem and approach

The conceptualisation of PPM is complex, as is evidenced by recent literature. Moreover, academic research about PPM focuses mostly on particular aspects, or a particular context, limiting the value for practitioners seeking a synthesis of the high-level concepts and guidance on the collection of practices. For researchers, no framework defines the collective practices and can be used to gauge the maturity of PPM.

Given the availability of research that deals with selected PPM practices from different perspectives, a systematic review that scrutinises the most prominent articles and provides a synthesis of authors’ previous work was seen as best suited to address the research problem. The use of a systematic review design was justified based on the coverage of PPM practices in academic literature, despite the absence of a universally accepted set of practices within both academia and practice.

3.2 Systematic review

Various guidelines have been developed to assist researchers in improving the scientific rigor of systematic reviews. This systematic review was conducted on extant literature according to the guidelines provided by Okoli and Schabram (2010), as indicated in Table 1.

The only deviation from the steps suggested by Okoli and Schabram (2010) was that the steps *searching literature*, *practical screening* and *quality appraisal* were not always done in sequence, but more in an iterative manner. No steps were omitted; some were just repeated to ensure a workable and reliable sample of literature.

In adherence to the initial research protocol, more than 1,000 articles were identified using the full-text search of ‘project’, ‘portfolio’, ‘management’ and ‘practices’. After that the search was adjusted to search for the phrase ‘PPM’ and the word ‘practices’, which identified the smaller number of 761 articles – but still too numerous to consider for review. It was then decided to search for the same words and phrases, but only those used in the previous ten years. This adjustment identified a manageable list of 85 articles.

This list included three PhD course work assignments, one patent, and nine books; all of these were removed. Finally, the articles were filtered to include only articles that had been cited at least once per year over the ten-year research period. This resulted in 47 articles (Figure 2).

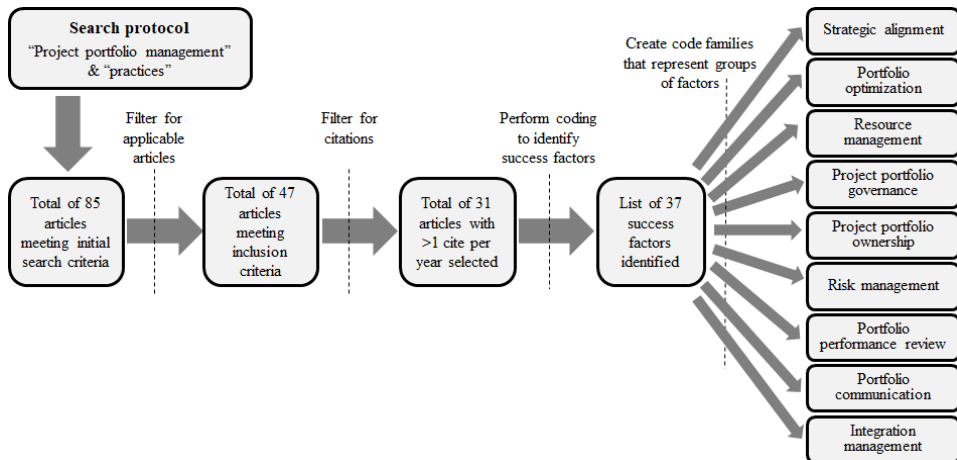
Table 1 Steps for systematic literature review

<i>Step</i>	<i>Description</i>	<i>Execution</i>
Planning	Define the purpose and intended goal of the systematic review.	Google Scholar was used because of its broad reach.
Protocol	Develop a protocol detailing the specific steps and procedures to be followed.	The search protocol was applied using the criteria as described below.
Searching literature	Search the literature, and describe and justify the details of the literature review search to ensure the comprehensiveness of the search.	The search initially yielded more than 1,000 articles, books and patents, and needed to be refined multiple times until a total of 85 items was realised.
Practical screening	Screen for inclusion to determine which studies are to be included in the review.	Screening was done to exclude unpublished PhD course work, patents and books.
Quality appraisal	Determine and score the quality of articles for inclusion and exclusion. Spell out the criteria for judging which articles are to be eliminated without further examination.	The articles were filtered to show only articles with more than one citation per year. The abstracts of the articles were downloaded and analysed individually to determine whether they mentioned/dealt with PPM practices.
Data extraction	Systematically extract the applicable information from the included studies, using appropriate techniques.	The data were extracted using context analysis to identify PPM practice codes and then code families to present the PPM practices.
Analysis	Analyse the data extracted.	
Documenting	Document the process in sufficient detail so that the results can be independently reproduced.	The results of the process are documented in the section on research results.

Source: Adapted from Okoli and Schabram (2010)

Quality appraisal of the 47 articles was done via perusal of abstracts, and a total of 37 articles relevant to the research question were identified. It was decided to use the 25 most cited articles and then to look for additional articles from the remaining 12 that dealt with PPM practices. Another six articles were identified, providing a final list of 31 peer-reviewed articles (see Appendix A).

Given an acceptable sample of 31 articles and their fitness for purpose based on the reviews of the abstracts, it was decided not to perform a systematic forward and backward search. This option was left open should there not be saturation towards the end of the analysis. Since no new code families emerged after the third article, and no new codes emerged after the tenth article, saturation was achieved. However, the entire selection of 31 articles was analysed before checking for saturation.

Figure 2 Search and review process for PPM practices

3.3 Qualitative coding

Following the coding of the 31 articles, a list of 37 different codes was generated. These codes were grouped into nine different code families, the PPM practices. Appendix B contains the codes and code families. Coding for the various practices presented some challenges arising from the interrelatedness of specific codes. An example is future preparedness that is strongly related to terminating under-performing projects (Rank et al., 2015). However, this practice maps to *strategic alignment via the future preparedness code* and *portfolio optimisation via the project selection/termination/delay code*.

Following the guidelines of Zhang and Wildemuth (2009) and using the constant comparative method, each new code created was first compared with the codes belonging to the family. The challenge of multiple codes for the same text has been acknowledged as normal and scientifically acceptable in qualitative analysis (Tesch, 2013). However, care was taken to ensure that the categories in the coding scheme were defined in such a way that they were internally as homogeneous as possible, and externally as heterogeneous as possible.

3.4 Limitation

Martinsuo (2013) argued that some topics were not yet being examined satisfactorily when dealing with PPM. She cautioned that extracting PPM practices from the literature should be done with care to ensure that less formal practices were not missed in such a process. Although care was taken to ensure that a rigorous process was followed in order to identify practices from the literature, it is indeed plausible that some existing PPM practices may not yet have been described in academic literature.

4 Research results

4.1 Synopsis

The practices identified in the selected articles are indicated in Table 2. The practices *strategic alignment*, *portfolio optimisation*, *project portfolio governance* and *resource management* made continued appearances in the literature. For *strategic alignment* and *resource management*, this is not surprising given every definition presented in the literature perused included alignment and resource allocation.

The term portfolio optimisation is not explicitly used in the literature. However, in principle, most of the actions commonly associated with PPM are actually about optimising the portfolio, be that through aligning, resourcing, selecting, or terminating projects. The typical environmental factors are coded in the *project portfolio governance* that deals with the formalisation of all the different techniques used for alignment, selection, allocation and management of the portfolio. It is thus not unexpected to see the high level of occurrence of these four code families.

Table 2 PPM practices

<i>PPM practice (prevalence)</i>	<i>Subcodes mapped to code family (prevalence)</i>
Strategic alignment (94%)	Portfolio objectives (71%); strategic alignment (87%); portfolio dynamic reassessment (55%); future preparedness (45%); value capturing (32%)
Portfolio optimisation (90%)	Portfolio prioritisation (55%); project selection/termination/delay (68%); portfolio categorisation (29%)
Project portfolio governance (90%)	Stakeholder interest (52%); stakeholder management (29%); portfolio leadership (52%); decision making (77%); facilitating control (52%); portfolio steering (42%); formalisation of PPM (48%)
Resource management (87%)	Resource management (87%); conflict management (35%); resource planning and scheduling (81%)
Portfolio performance review (77%)	Portfolio return on investment (ROI) (45%); portfolio efficiency (45%); portfolio performance (65%)
Integration management (74%)	Cross-functional integration (55%); project interdependence (55%); portfolio collaboration (39%); single project influence (39%); organisational complexity (35%)
Project portfolio ownership (65%)	Management support (48%); organisational learning (45%); portfolio manager empowerment (35%)
Portfolio risk management (65%)	Managing uncertainty (42%); portfolio risk (61%); portfolio uncertainty (35%); risk management (61%)
Portfolio communication (65%)	Information needs (55%); information sharing (42%); communication (52%)

At the lower end of occurrence are *project portfolio ownership*, *portfolio risk management* and *portfolio communication*. The concepts of ownership and communication are not well covered in literature and are often not seen by authors as essential to PPM practices. However, the relatively low presence of practices related to risk management is somewhat surprising given the origin of PPM in portfolio theory with its strong risk emphasis.

None of the 31 articles selected intended to provide a comprehensive set of practices for PPM. It was thus to be expected that not all articles would contain all practices. Given the relatively high presence (65%) of the least covered practice, it is unlikely that a PPM practice was missed entirely in the selection and analysis. Each of the individual practices (code families) is briefly discussed below.

4.2 *Strategic alignment*

The concept of strategic fit stems from organisational research with the central proposition that performance of an organisation is the result of fit between two or more factors, such as strategy, structure, technology and environment (Meskendahl, 2010). In this instance, alignment refers to the contribution of the collective projects towards the organisation's strategic intent. A coordinated project portfolio represents an organisation's investment strategy and delivers increased benefits to the organisation beyond the results of projects managed independently by leveraging synergies.

The strategic fit of a portfolio describes the degree to which the entire project portfolio reflects the business strategy. PPM is essential to realising business strategy and strongly influences the future competitive position of organisations (Gutiérrez and Magnusson, 2014). Intertwined with clear portfolio objectives is the concept of strategic fit. Strategic fit is central to the value embedded in PPM and is unlocked through appropriate PPM practices. Daniel et al. (2014) defined the attainment of strategic fit as the prioritisation of an organisation's projects and programs in line with business objectives, and matching these to the capacity to deliver them. Gutiérrez and Magnusson (2014) indicated that PPM could be described as a dynamic decision-making process in which the portfolio of active projects is continuously reviewed and updated.

Future preparedness and value capturing may not have appeared often in the selected literature. However, these practices do represent essential aspects of PPM and substantiate the importance of strategic alignment with both current value realisation and future-oriented (strategic posturing) stance. Future preparedness reflects the preparedness of the organisation and its technological infrastructure for future needs (Voss, 2012). It evaluates the long-term benefits and opportunities offered by the projects that can eventually be realised well after the projects have been completed.

A contentious sub-practice is that of *value capturing*. The initial code was *value capturing and creation*. The value creation argument was mostly based on Voss (2012), who contends that the PPM value creation process transforms results of strategy development into propositions to create value, both for the customer and for the organisation. The research context of Voss (2012) was deeply customer-centric and cannot be generalised for PPM. PPM is not a value creation process, and the code was updated for this study to indicate value capturing only – which was supported by multiple other articles.

4.3 *Portfolio optimisation*

An effective process to determine which projects to include in a portfolio is essential. For PPM to deliver value, individual projects must be continually added, where after the portfolio should be reprioritised; pruned by terminating weak performing projects, and realigned with the strategy (Petit, 2012). A significant proportion of literature focuses on highly quantitative selection algorithms. In the complex and dynamic environments in

which project selections are made, this type of research has minimal value for practitioners since selecting projects is not only a rational quantitative decision-making process.

On an ongoing basis, newly initiated projects become candidates to be included in the portfolio (Pajares and López, 2014). Conversely, the continual monitoring and rebalancing of the portfolio mean that a project can be deprioritised or be terminated if it does not deliver sufficient value or is aligned to an outdated strategy (LaBrosse, 2010; Killen and Hunt, 2013).

When multiple projects consume a single pool of limited resources, prioritisation of individual projects is critical to ensure that projects with the highest value contribution are added to the portfolio. Along with the prioritisation, the project also inherits the right to consume resources (Brook and Pagnanelli, 2014). The dynamic nature of individual projects poses a challenge as a project's value contribution could change at any stage during the project life cycle. Keeping a balanced portfolio requires regular operational and business value measures based on the current status of projects, business requirements and strategic intent (Kaiser et al., 2015).

The categorisation of projects is different from prioritisation. Categorisation could be done for various reasons, including prioritisation, communication, or reporting. Killen and Hunt (2013), for example, categorised projects as short-term exploitation projects and long-term exploration projects. PPM capability should be tailored to cater for any organisation's specific context and project categories. Monitoring and managing the balance between firmness and flexibility is a vital optimisation practice (Killen and Hunt, 2013).

4.4 Project portfolio governance

Coding for *project portfolio governance* presented a challenge as the codes overlapped considerably with codes used for other practices. It was decided to keep this as a separate practice that focuses on stakeholders, leading, controlling, and decision-making which is not sufficiently explicit in any of the other practices. Beringer et al. (2013) provided a classification of PPM based on a process-oriented understanding of portfolio management structured in three phases: portfolio structuring, resource management and portfolio steering. The first two groups of managerial activities have already been dealt with in the practices as mentioned earlier; it is the portfolio steering that was coded for in this practice.

This steering of the portfolio is different from decision-making, since it includes ensuring that decisions that are important in the direct project and portfolio activities, intra-portfolio or even intra-project activities, are executed. Decision-making on project and portfolio selection is less planned and rational and more political and path-dependent than the normative models would suggest (Martinsuo, 2013). Studies about PPM in practice have shown that managers' actions and decision-making involve intuition, negotiation and even bargaining, but these concepts are not accounted for in the PPM frameworks built upon rational portfolio decision-making (Martinsuo, 2013).

Project portfolio governance describes the firm's ability to integrate the PPM practices into its existing processes. In a mature PPM system, the concept of governance would mean that all stakeholders discharge of their responsibilities appropriately (Beringer et al., 2012). Different organisational roles contribute to the leadership requirements for portfolio success. The CEO and executive managers are responsible for

managing the portfolio. Tactical and operational decisions and coordination of multiple projects are carried out by program, project and resource managers (Pajares and López, 2014). Project portfolio managers need both a strategic vision (understanding portfolio strategy) and operational oversight (collecting and analysing information) to be able to make

context-relevant decisions and steer project portfolios successfully (Beringer et al., 2013).

Steering includes dealing with strategic (affecting) stakeholders and moral (being affected) stakeholders (Beringer et al., 2013). Because specific stakeholders can influence other stakeholders, and indirectly wield significant influence, this practice includes the steering activities that will direct stakeholders for the benefit of the entire portfolio. The formalisation of portfolio processes significantly affects portfolio performance (Korhonen et al., 2014).

4.5 Resource management

The effective allocation of resources according to an organisation's objectives and management of the difference between its actual and intended state is fundamental to strategy implementation. Unsurprisingly, *resource management* is a crucial PPM practice (Kaiser et al., 2015). To avoid resource bottlenecks and to provide for the efficient use of resources, the effective assignment of the organisation's resources to the projects is crucial (Frey and Buxmann, 2011).

Optimising resource allocations is complicated due to multiple project activities at different rates of consumption and with different due dates (Laslo, 2010). Academic literature has focused on the resource-constraint multi-project approach using quantitative models to allocate resources optimally. Although the scheduling and allocation of resources to multiple projects are indeed complex, the rigorous mathematical models proposed have limited utility in real portfolios where it is difficult to mathematically formalise both objective functions and constraints (Pajares and López, 2014).

Cross-project resource planning and resource approval are undoubtedly some of the most conflict-ridden aspects in portfolio management. The handling of resource conflicts between competing projects as well as between resource-demanding and resource-supplying management roles is a significant practical challenge for organisations. Jonas (2010) contended that PPM practices could reduce the potential conflicts between line managers and project managers significantly, and most authors support this view. Laslo (2010) contended that a significant challenge was to find a way of handling resource scarcity, given the overall strategic direction of the corporation. An essential supporting contribution of PPM is ensuring the right number of projects in the portfolio in proportion to the resources available (Lerch and Spieth, 2013).

LaBrosse (2010) argued that PPM is a zero-sum game, i.e., not value-adding, but value-capturing. Managers of project portfolios determine which resources will be taken from some projects and given to others, and which projects should be put on hold. This re-allocation of resources in the firm requires portfolio managers with well-developed interpersonal skills to manage the process. When it comes to resource allocation, more often than not it is not about algorithmic allocation of resources in a highly structured way – negotiation skills, statesmanship, and tact in dealing with competing demands among stakeholders are just as necessary as technical skills (LaBrosse, 2010).

4.6 Portfolio performance review

There is a significant difference between single project success and average project success across the entire portfolio (Beringer et al., 2013). From the *portfolio performance review* perspective, the organisation is a set of projects implementing strategy through the effective allocation of resources (Pajares and López, 2014). A fundamental argument supporting PPM is the higher degree of efficiency that is obtained when the projects are managed as a portfolio, rather than separately, thus achieving a higher level of portfolio performance.

PPM as a decision-making practice maximising the ROI and requires insight into both the investment and the astute management of the return of all projects in the portfolio (Gutiérrez and Magnusson, 2014). A crucial enabler of portfolio success in dynamic environments is flexible processes, called organisational agility. According to Heising (2012), this flexibility entails implementing not only selection mechanisms when projects enter the portfolio, but also the subsequent PPM processes that deal with the ongoing management of the portfolio, to ensure flexibility.

The decision whether to include or exclude a project from a portfolio depends on its financial and strategic value. It should also account for how the new project could fit into the structure of schedules and allocation of resources of previous projects (Pajares and López, 2014). Portfolio efficiency is a complex measure and requires a portfolio overview and insight into how each changing element will impact the balance from strategic alignment to resource allocation. Adding to the complexity is how the individual project's cash flow profile and capital cost requirements interact with the cash flow and capital cost of the existing portfolio (Pajares and López, 2014).

Authors agree that financial criteria alone are insufficient for a long-term view of success. Some authors developed multidimensional concepts of performance; however, financial performance criteria still constitute the first dimension of project portfolio success (Voss, 2012). Portfolio performance is probably the practice with the least amount of conceptual convergence in the literature.

4.7 Integration management

In the academic literature, integration management is often covered in principle but is mostly absent in name and focus. For example, the prioritisation of each project added to the portfolio is discussed, but the reprioritisation of existing projects remaining in the portfolio is ignored. Another example, dealt with in slightly more detail in the literature, is the concept of portfolio risk and return that changes with each project added to, or removed from, the portfolio (Lerch and Spieth, 2013).

Virtually all authors have dealt with project selection but stop short of dealing with the integration requirements as part of the selection criteria. Teller (2013) acknowledged the complexity and integration practices and stressed the importance of managing the interfaces between different projects. The decision to add projects to a portfolio depends not only on the project's features such as strategic alignment, financial value, and ROI or risk, but also on how the new project affects some properties of the existing portfolio (Pajares and López, 2014).

It is also possible that the outcomes of projects may support each other, or have a negative effect on each other (Brook and Pagnanelli, 2014). Project synergies describe the cooperation between the individual projects of a specific portfolio; for example,

dependencies or heightened value can result from projects using the same technology or acting upon the same clients or market (Teller, 2013). The management of interdependencies allows for the realisation of synergies that may increase efficiency or shared opportunities, or for the acknowledgement of the negative impact of projects that may reduce the positive outcomes of another.

PPM practices include the optimal alignment of projects to each other (Jonas et al., 2013). This implies the pursuit of projects that are aligned with business strategy given their inter-project alignment and resource commitments aligned with strategic objectives. Teller et al. (2012) contended that project portfolio complexity also increases the opportunity to leverage synergies in knowledge, technological platforms, or customers, beyond the risk and resources argument prevalent in the literature. To strengthen core competencies and reduce redundant work, it is essential to actively consider not only the complexity within the portfolio, but also the portfolio in the context of the organisation.

Although authors are at pains to explain the inter-project collaboration and the attainment of organisational efficiencies when projects are prioritised correctly, and resources are optimally allocated, this is only possible if integration exists at the strategic level (across all strategic imperatives) and the operational level (across all line management functions).

4.8 Project portfolio ownership

The *project portfolio ownership* code family initially contained both the terms 'ownership' and 'maturity' since several articles referred to the importance of achieving a certain level of maturity in PPM. It was decided to use the code family ownership since it represents maturity, or how well PPM is practiced, and actions to improve maturity as an indicator of organisational ownership of PPM.

Management accountability for project portfolios has repercussions for organisations (Teller et al., 2012). Organisational learning plays an important role and is realised through a re-evaluation of project results and by utilising post-project reviews, in the portfolio context. Organisational learning is aimed at securing and maintaining relevant knowledge for the organisation to strengthen portfolio-level capabilities.

PPM ownership can provide organisational agility and contribute to creating value in dynamic environments (Killen and Hunt, 2013). However, PPM practices and capabilities must be tailored to the context and should be adjusted over time when the context changes (Killen and Hunt, 2013). This higher level of maturity should be done in a coordinated and consistent manner since the uncoordinated evolution of PPM capabilities can result in undesirable changes to the PPM capability such as the 'success trap' [Killen and Hunt, (2013), p.140]. This happens where organisational decision-making evolves to favour short-term, incremental, or low-risk 'exploitation' projects, at the expense of the more radical, breakthrough, longer-term 'exploration' projects that organisations believe are essential for long-term success.

Despite the risk of decreased agility, PPM formalisation is essential and even more so when portfolio complexity is high. Formalisation increases the availability and richness of information, ensures clear responsibilities and commitment reliability, and facilitates resource prioritisation and allocation (Teller, 2013). PPM practices need to be formalised to ensure their efficient execution, and ownership provides the balance for the required agility to allow adaptation as mandated by different contexts.

Although practitioners will benefit most from PPM formalisation, it should never be done at the expense of empowering portfolio managers, especially in more complex and dynamic environments. Agility is mostly the result of pragmatic decision-making. As more PPM practices are established and embedded in the organisation, the ability of project portfolio managers to make empowered decisions is critical to maintaining portfolio agility.

4.9 Portfolio risk management

Although *portfolio risk management* is not the most prevalent of the PPM practices, the articles that cover it make a strong case for the inherent value of managing risk at the portfolio level. Teller and Kock (2013) analysed the six components of portfolio risk management, of which two, *portfolio risk identification* and *integration of risk management into PPM* are unique to portfolio management.

PPM uncertainties have been covered in academic literature in three main areas (Martinsuo and Killen, 2014). Firstly, multiple authors have argued that organisational context causes uncertainties and requires different management practices to make the portfolio successful. Secondly, a few studies have directed attention to environmental uncertainties, such as market and technology turbulence and customer requirements. Thirdly, changes at the individual project level have been considered relevant in generating uncertainty at the portfolio level. Uncertainty has severe implications for PPM for those managing portfolio risks at multiple levels.

Organisations mostly considered risk only at the individual project level, without attention to the overall portfolio risk (Daniel et al., 2014). The introduction of PPM considers the risks across projects, such as project interdependencies and overall portfolio risk. The portfolio risk practice deals with the risks directly affecting variables like ROI, profits, value, and market share, compared to project risk management that is about the issues affecting the success of individual projects (Pajares and López, 2014).

Every new project added to or removed from a portfolio affects the overall portfolio risk. Portfolio risk entails how a project interacts with the sources of risk of the existing portfolio. Lerch and Spieth (2013) called these ‘complementary projects’ that might change the portfolio risk profile of a portfolio depending on how well or how poorly they complement the portfolio. The selection of the correct projects in terms of risk is a complex task involving a high level of uncertainty (Kaiser et al., 2015). When this is taking place in a dynamic environment with projects entering and exiting the portfolio continually, exceptional management ability is required.

Teller (2013) contended that a robust risk management culture is a vital component in increasing the effectiveness of risk management processes. A risk management culture incorporates risk awareness, commitment, acceptance, communication, openness, risk tolerance and trust (Teller, 2013). This is substantially beyond the typical processes identified by most authors and requires a high level of PPM maturity.

4.10 Portfolio communication

Portfolio communication is multi-dimensional because of the strategic (alignment), tactical (prioritisation), operational (resource allocation) and project (individual performance) requirements that meet in one organisational role (Jonas, 2010). Effective communication is often described in the literature as establishing complete visibility

across the entire scope of projects in a project portfolio. It is evident from the PPM literature that significant value is derived from appropriate portfolio communication.

Information quality and transparency over the entire project portfolio are the foundation of sound decision-making and ensure, among others, the appropriate prioritisation of projects (Teller et al., 2012). Decision-making at the portfolio level in a dynamic environment relies on quality information. The decision maker's ability and quality of information ultimately leads to appropriate decisions – which indicates the importance of empowering project portfolio managers (Kaiser et al., 2015). Dynamic environments increase the emphasis on understanding information needs and the ability to collect and prepare information for decision-making as an essential practice (Kaiser et al., 2015).

Once decisions have been made, they need to be communicated, along with measurement criteria, to achieve their expected or intended impact. Distributing the information about decisions made is as an important part of the practice as gathering information to make decisions. Communication will enable organisations to address the major challenges in PPM that include achieving operational transparency with all projects, providing strategic direction for the projects, and establishing cross-project coordination (Jonas et al., 2013).

Daniel et al. (2014) presented evidence that PPM gave the leaders of some organisations greater visibility of all major project activities across the firm, which enabled them to anticipate and resolve resource issues before they arose and to reduce expenditure on external resources without affecting project plans. However, it is difficult to generate information about processes that are not monitored on an ongoing basis. The extent to which activities are measured determines the quality of information on which decisions regarding prioritisation and selection of projects are made.

Cross-project optimisation and mutual collaboration across project borders are only possible with continual delivery of timely and reliable project status information (Beringer et al., 2013). Improved PPM communication quality enables better management decisions, and in turn, greater portfolio success (Jonas, 2010; Teller et al., 2012).

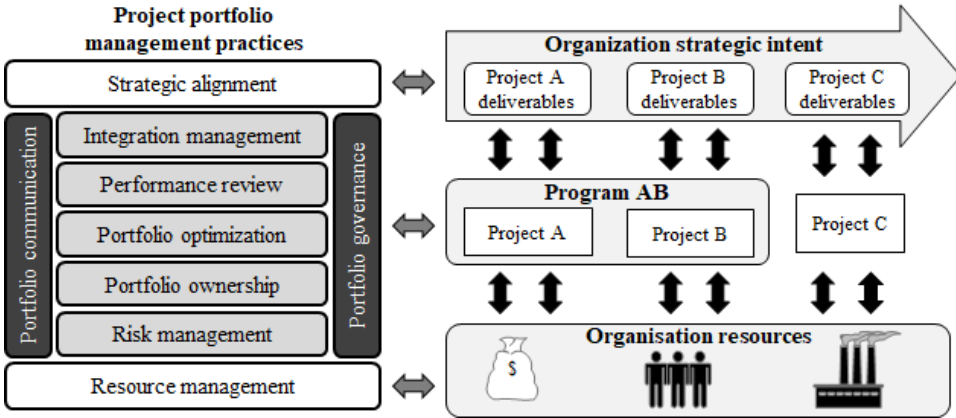
4.11 Synthesis

The strategic and operational value of PPM, comprising the identified set of practices, is evident. During the coding and the description of the practices the degree of interdependency between the different practices and other organisational roles became evident. Figure 3 provides a synopsis of the collection of practices identified and their interaction with other management roles presented in Figure 1. From a practitioner perspective, PPM needs to be seen in context to completely understanding the interdependency of the different practices and management responsibilities in an organisation.

Strategic alignment of the collective portfolio of projects is interdependent on existing strategic management practices and finds strong support in the literature. While executing the tasks that comprise this practice, project portfolio managers will work closely with management roles defining and executing strategic intent. Likewise, in the execution of the *resource allocation* tasks, project portfolio managers will interact with

multiple operational management roles. Resource allocation complexities are well-recognised in academic literature, although at times more mechanistic and probabilistic than the more pragmatic and collaborative reality of making trade-offs and negotiating for what may be required in practice.

Figure 3 PPM practices and interaction with other management roles



Two practices that integrate the tasks from the operational to the strategic level are *portfolio communication* and *portfolio governance*. Portfolio communication encapsulates the gathering of portfolio information for communication from as to all the roles which are impacted by the project portfolio and portfolio decisions and well as within-portfolio decisions. The portfolio communication practice comprises understanding the full scope of decision-making required in PPM, and the information needed to support the decisions, and emanating from decisions made. Portfolio governance tasks ensure the necessary conditions for the efficient execution of all the PPM practices. Effective governance empowers portfolio managers to compromise pragmatically and make decisions in the best interest of the collective portfolio, without unnecessary bureaucracy. As more PPM processes are embedded in the organisation, the ability of project portfolio managers to make empowered decisions is critical to maintaining portfolio agility and performance.

The remainder of the practices, namely *portfolio optimisation*, *performance review*, *integration management*, *risk management* and *portfolio ownership*, all play an essential intra-portfolio part. Their combined execution plays a pivotal role in the optimisation of value and reducing risk for any given context. The collaborative management of these practices is required to provide the best value return for the portfolio.

5 Recommendations and research limitations

The earlier literature on PPM often provided in-depth empirical work on a particular practice, for example, the assignment of resources, alignment with strategy, or management of portfolio risk. This focus seems to have missed the dynamic nature of the

entire set of practices required to manage the project portfolio effectively. Even when dealing with a seemingly discrete practice like resource allocation, practices from within the communication and integrations groups will contribute to the efficient allocation of resources. Managing a portfolio cannot be limited to focusing on individualised practices, and cognisance needs to be taken of the entire set of tasks and all nine practice domains.

For researchers and practitioners alike, this article provides a synopsis of the set of practices that present the discipline from a theoretical perspective, addressing the weaknesses in PPM literature and practice identified by Clegg et al. (2018), Hansen et al. (2019), Martinsuo and Geraldi (2020) and Young and Conboy (2013). Having a cohesive and comprehensive set of high-level practice groups will assist practitioners in assigning clear accountability to managers responsible for the appropriate management and governance of the portfolio.

This article offers three implications for practice. Firstly, the study provides a more nuanced understanding of the relationship between project portfolio activities and their interdependence on other roles within organisations. The results showed that each practice consists of a unique collection of tasks are interdependent on other practices (see Figure 3), and will require interaction with line management roles outside the portfolio and constituent projects and programs. Although previous research acknowledged the complexity of specific PPM practices, like the optimal allocation of resources in a constraint environment, it at times failed to recognise the complex interdependency between the different tasks contained within a practice.

Secondly, each of the nine practice domains represents project portfolio managers with a comprehensive set of tasks to consider when managing their portfolios. The complexity of PPM requires project portfolio managers to consider the entire collection of practices, even when dealing with one particular activity when discharging their duties. Thirdly, the article calls for a more integrative view on the portfolio tasks, bringing the project portfolio managers into the field of operations management and strategy formulation to be able to manage the complexity of the portfolio within the business context. Rather than becoming experts at some complex technique that may only be useful under strict boundary conditions that are seldom, if ever, experienced in practice, project portfolio managers require a broad set of skills to manage all nine practice domains.

A few factors limited the research. Firstly, the selection protocol used the most cited academic literature. This could create an intellectual echo chamber supporting the most prominent voices in the academic discourse. It is plausible that fringe articles that did not meet inclusion criteria contain novel or emergent practices not yet sufficiently covered in academic research. Secondly, a similarly structured scrutiny of the growing body of practitioner literature could lead to additional insights about PPM practices that are yet to be identified and covered by academic research. Guiding practitioners purely from academic literature may not be the optimal research design. Finally, all structured literature reviews can suffer from publication bias that occurs when researchers decide not to publish primary studies with statistically insignificant, weak or strange results (Nelson and Kennedy, 2009). These potentially weak signals of less prominent PPM tasks could enrich a study of this nature.

6 Conclusions and future research

The increased use of projects and programs have led to a proliferation of project portfolios within organisations (Martinsuo and Geraldi, 2020). Although the literature on PPM continues to grow, overviews of the state-of-the-art of PPM research and its processes remain scarce (Yamakawa et al., 2019).

The individual practices share common themes, yet the constituent concepts are given different codes in the considered literature. The golden thread that aligns the practices to form a single guiding principle was identified in this research by following an inductive approach. The main finding in terms of PPM practices is that although they are disparate on a conceptual level, common focus areas can be identified across academic articles when grouped into logical practice-oriented code families. The common focus on a particular PPM practice in the literature, and the limited theoretical reflection on their interdependence, motivated the exploration of all activities that are included under PPM.

The diverse nature of PPM academic literature was corroborated in this systematic review. It is evident that the academic view on PPM is not well-synthesised, and subsets of practices are distributed across multiple articles. Appendix B contains a mapping of the codes and the code families to the articles analysed. Only six (19%) of the 31 articles of the most cited research on PPM included at least one task from all nine code families, and not a single article contained all 37 codes that emerged from the analysis. Based on the lack of a consolidated theoretical perspective, this research contributes to the PPM body of knowledge by providing a set of practices that encapsulates all actions that should be performed by project portfolio managers.

The management and governance of project portfolios require a variety of stakeholders and skills. For example, where current PPM research often tends to reduce the complexity of the strategic management processes by using a one-dimensional term such as 'strategy alignment', project portfolios should be viewed as mechanisms for implementing strategy, but also shaping strategy since it presents as a strategic capacity within organisations. This offers novel possibilities for research on strategy, and in particular, the notion of dynamic capabilities. Researchers are encouraged to use the theoretical base of dynamic capabilities from the strategic management literature to explore the field of PPM further.

For research to guide practice credibly there is a need to understand which project portfolio routines and practices are useful under which conditions. For researchers, the findings enable future research to validate the relevance of these practices more comprehensively and systemically. It will be valuable to test for the presence of collective practices in organisations with high levels of PPM maturity. Researchers are also encouraged to explore the interdependency of the multiple PPM practices further by using theoretical lenses and research methods that embrace the dynamic complexity of multiple tasks that need to be managed interdependently.

The research results build on the existing PPM literature to contribute to the ongoing strengthening of practice-based research. The results allude to a research agenda that opens up new research streams for validating PPM tasks in practice, understanding and embracing PPM practice interdependence, and potentially exploring the complexity of PPM interdependence with other management domains.

References

- Beringer, C., Jonas, D. and Gemünden, H.G. (2012) 'Establishing project portfolio management: an exploratory analysis of the influence of internal stakeholders' interactions', *Project Management Journal*, Vol. 43, No. 6, pp.16–32.
- Beringer, C., Jonas, D. and Kock, A. (2013) 'Behavior of internal stakeholders in project portfolio management and its impact on success', *International Journal of Project Management*, Vol. 31, No. 6, pp.830–846.
- Biedenbach, T. and Müller, R. (2012) 'Absorptive, innovative and adaptive capabilities and their impact on project and project portfolio performance', *International Journal of Project Management*, Vol. 30, No. 5, pp.621–635.
- Blichfeldt, B.S. and Eskerod, P. (2008) 'Project portfolio management: there is more to it than management enacts', *International Journal of Project Management*, Vol. 26, No. 4, pp.357–365.
- Brook, J.W. and Pagnanelli, F. (2014) 'Integrating sustainability into innovation project portfolio management: a strategic perspective', *Journal of Engineering and Technology Management*, Vol. 34, pp.46–62.
- Campbell, R. and Park, R. (2004) 'Stop kissing frogs', *Harvard Business Review*, July/August, Vol. 82, Nos. 7–8, pp.27–28.
- Clegg, S., Killen, C.P., Biesenthal, C. and Sankaran, S. (2018) 'Practices, projects and portfolios: current research trends and new directions', *International Journal of Project Management*, Vol. 36, No. 5, pp.762–772.
- Costantino, F., Di Gravio, G. and Nonino, F. (2015) 'Project selection in project portfolio management: an artificial neural network model based on critical success factors', *International Journal of Project Management*, Vol. 33, No. 8, pp.1744–1754.
- Daniel, E.M., Ward, J.M. and Franken, A. (2014) 'A dynamic capabilities perspective of IS project portfolio management', *The Journal of Strategic Information Systems*, Vol. 23, No. 2, pp.95–111.
- Dolci, P.C. and Maçada, A.C.G. (2011) 'Section 10: portfolio theory: the contribution of markowitz's theory to information system area', in Dwivedi, Y.K. and Wade, M.R. (Eds.): *Information Systems Theory*, Vol. 1, pp.199–211, Springer, New York, USA.
- Frey, T. and Buxmann, P. (2011) 'The importance of governance structures in IT project portfolio management', in *Proceedings of the 2011 19th European Conference on Information Systems (ECIS)*, Helsinki, Finland, June [online] <https://www.semanticscholar.org/paper/The-importance-of-governance-structures-in-IT-Frey-Buxmann/0cff9bda0ba6f4396861db4020b027d507398971> (accessed 15 May 2019).
- Frey, T. and Buxmann, P. (2012) 'IT project portfolio management: a structured literature review', in *Proceedings of the 2012 20th European Conference on Information Systems (ECIS)*, Spain, Barcelona, June [online] <https://pdfs.semanticscholar.org/3ccc/b0c05ad60745e927bc27cd5623606f7287fd.pdf> (accessed 15 May 2019).
- Gutiérrez, E. and Magnusson, M. (2014) 'Dealing with legitimacy: a key challenge for project portfolio management decision makers', *International Journal of Project Management*, Vol. 32, No. 1, pp.30–39.
- Hansen, L.K., Rode, A.L.G., Sommer, A.F. and Svejvig, P. (2019) 'Toward a project portfolio management evaluation framework', *Proceedings of European Academy of Management (EURAM) Conference 2019*.
- Heising, W. (2012) 'The integration of ideation and project portfolio management: a key factor for sustainable success', *International Journal of Project Management*, Vol. 30, No. 5, pp.582–595.
- Hyväri, I. (2014) 'Project portfolio management in a company strategy implementation: a case study', *Procedia – Social and Behavioral Sciences*, Vol. 119, pp.229–236.

- Jonas, D. (2010) 'Empowering project portfolio managers: how management involvement impacts project portfolio management performance', *International Journal of Project Management*, July, Vol. 28, pp.818–831.
- Jonas, D., Kock, A. and Gemünden, H.G. (2013) 'Predicting project portfolio success by measuring management quality: a longitudinal study', *IEEE Transactions on Engineering Management*, Vol. 60, No. 2, pp.215–226.
- Kaiser, M.G., El Arbi, F.L. and Ahlemann, F. (2015) 'Successful project portfolio management beyond project selection techniques: understanding the role of structural alignment', *International Journal of Project Management*, Vol. 33, No. 2015, pp.126–139.
- Killen, C.P. and Hunt, R.A. (2010) 'Dynamic capability through project portfolio management in service and manufacturing industries', *International Journal of Managing Projects in Business*, Vol. 3, No. 1, pp.157–169.
- Killen, C.P. and Hunt, R.A. (2013) 'Robust project portfolio management: capability evolution and maturity', *International Journal of Managing Projects in Business*, Vol. 6, No. 1, pp.131–151.
- Killen, C.P., Jugdev, K., Drouin, N. and Petit, Y. (2012) 'Advancing project and portfolio management research: applying strategic management theories', *International Journal of Project Management*, Vol. 30, No 5, pp.525–538.
- Koh, A. and Crawford, L. (2012) 'Portfolio management: the Australian experience', *Project Management Journal*, Vol. 43, No. 6, pp.33–42.
- Koller, T., Lovallo, D. and Williams, Z. (2019) 'Bias buster: pruning projects proactively', *McKinsey Quarterly*, February [online] <https://www.mckinsey.com/business-functions/strategy-and-corporate-finance/our-insights/bias-busters-pruning-projects-proactively> (accessed 9 July 2019).
- Korhonen, T., Laine, T. and Martinsuo, M. (2014) 'Management control of project portfolio uncertainty: a managerial role perspective', *Project Management Journal*, Vol. 45, No. 1, pp.21–37.
- LaBrosse, M. (2010) 'Project-portfolio management', *Employment Relations Today*, Vol. 37, No. 2, pp.75–79.
- Laslo, Z. (2010) 'Project portfolio management: an integrated method for resource planning and scheduling to minimize planning and scheduling-dependent expenses', *International Journal of Project Management*, Vol. 28, No. 6, pp.609–618.
- Lee, J.W. and Kim, S.H. (2000) 'Using analytic network process and goal programming for interdependent information system project selection', *Computers and Operations Research*, Vol. 27, No. 4, pp.367–382.
- Lerch, M. and Spieth, P. (2013) 'Innovation project portfolio management: a qualitative analysis', *IEEE Transactions on Engineering Management*, Vol. 60, No. 1, pp.18–29.
- Martinsuo, M. (2013) 'Project portfolio management in practice and in context', *International Journal of Project Management*, Vol. 31, No. 6, pp.794–803.
- Martinsuo, M. and Killen, C.P. (2014) 'Value management in project portfolios: identifying and assessing strategic value', *Project Management Journal*, Vol. 45, No. 5, pp.56–70.
- Martinsuo, M. and Geraldi, J. (2020) 'Management of project portfolios: relationships of project portfolios with their contexts', *International Journal of Project Management*, Vol. 38, No. 7, pp.441–453.
- Meskendahl, S. (2010) 'The influence of business strategy on project portfolio management and its success: a conceptual framework', *International Journal of Project Management*, Vol. 28, No. 8, pp.807–817.
- Moore, S. (2010) *Strategic Project Portfolio Management: Enabling a Productive Organization*, John Wiley & Sons, Hoboken, New Jersey, USA.
- Munns, A.K. and Bjeirmi, B.F. (1996) 'The role of project management in achieving project success', *International Journal of Project Management*, Vol. 14, No. 2, pp.81–85.

- Nelson, J.P. and Kennedy, P.E. (2009) 'The use (and abuse) of meta-analysis in environmental and natural resource economics: an assessment', *Environmental and Resource Economics*, Vol. 42, No. 3, pp.345–377.
- Nikolova, N.I. (2016) 'Strategic context of project portfolio', *Management Journal of Innovations and Sustainability*, Vol. 2, No. 2, pp.31–43.
- Okoli, C. and Schabram, K. (2010) 'A guide to conducting a systematic literature review of information systems research', *Sprouts: Working Papers on Information Systems*, Vol. 10, No. 26 [online] <http://sprouts.aisnet.org/10-26> (accessed 14 June 2019).
- Pajares, J. and López, A. (2014) 'New methodological approaches to project portfolio management: the role of interactions within projects and portfolios', *Procedia – Social and Behavioral Sciences*, Vol. 119, pp.645–652.
- Patanakul, P. (2015) 'Key attributes of effectiveness in managing project portfolio', *International Journal of Project Management*, Vol. 33, No. 5, pp.1084–1097.
- Pennypacker, J. and Cabanis-Brewin, J. (2003) *Why Corporate Leaders Should Make Project Portfolio Management a Priority* [online] <http://www.cpbonline.com> (accessed 8 April 2019).
- Petit, Y. (2012) 'Project portfolios in dynamic environments: organizing for uncertainty', *International Journal of Project Management*, Vol. 30, No. 5, pp.539–553.
- Rabbani, M., Bajestani, M.A. and Khoshkhou, G.B. (2010) 'A multi-objective particle swarm optimization for project selection problem', *Expert Systems with Applications*, Vol. 37, No. 1, pp.315–321.
- Rajegopal, S. (2013) *Portfolio Management: How to Innovate and Invest in Successful Projects*, Palgrave Macmillan, Hampshire, UK.
- Rank, J., Unger, B.N. and Gemünden, H.G. (2015) 'Preparedness for the future in project portfolio management: the roles of proactiveness, riskiness and willingness to cannibalize', *International Journal of Project Management*, Vol. 33, No. 8, pp.1730–1743.
- Siew, R.Y.J. (2016) 'Integrating sustainability into construction project portfolio management', *KSCCE Journal of Civil Engineering*, Vol. 20, No. 1, pp.101–108.
- Stewart, R. and Mohamed, S. (2002) 'IT/IS projects selection using multi-criteria utility theory', *Logistics Information Management*, Vol. 15, No. 4, pp.254–270.
- Teller, J. (2013) 'Portfolio risk management and its contribution to project portfolio success: an investigation of organization, process and culture', *Project Management Journal*, Vol. 44, No. 2, pp.36–51.
- Teller, J. and Kock, A. (2013) 'An empirical investigation on how portfolio risk management influences project portfolio success', *International Journal of Project Management*, Vol. 31, No. 6, pp.817–829.
- Teller, J., Unger, B.N., Kock, A. and Gemünden, H.G. (2012) 'Formalization of project portfolio management: the moderating role of project portfolio complexity', *International Journal of Project Management*, Vol. 30, No. 5, pp.596–607.
- Tesch, R. (2013) *Qualitative Research: Analysis Types and Software*, Routledge, London, UK.
- Unger, B.N., Kock, A., Gemünden, H.G. and Jonas, D. (2012) 'Enforcing strategic fit of project portfolios by project termination: an empirical study on senior management involvement', *International Journal of Project Management*, Vol. 30, No. 6, pp.675–685.
- Voss, M. (2012) 'Impact of customer integration on project portfolio management and its success: developing a conceptual framework', *International Journal of Project Management*, Vol. 30, No. 5, pp.567–581.
- Wei, C.C., Chien, C.F. and Wang, M.J.J. (2005) 'An AHP-based approach to ERP system selection', *International Journal of Production Economics*, Vol. 96, No. 1, pp.47–62.
- Yamakawa, E.K., Cauchick-Miguel, P.A., Sousa-Zomer, T.T. and Killen, C.P. (2019) 'Project portfolio management: a landscape of the literature', *International Journal of Business Excellence*, Vol. 18, No. 4, pp.450–487.

- Young, M. and Conboy, K. (2013) 'Contemporary project portfolio management: reflections on the development of an Australian competency standard for project portfolio management', *International Journal of Project Management*, Vol. 31, No. 8, pp.1089–1100.
- Zhang, Y. and Wildemuth, B.M. (2009) 'Section 30: qualitative analysis of content', in Wildemuth, B.M. (Ed.): *Applications of Social Research Methods to Questions in Information and Library Science*, pp.308–319, Libraries Unlimited, Westport, Connecticut, USA.

Appendix A

Table A1 Articles analysed in the systematic review for PPM practices

<i>Cites/year</i>	<i>Authors</i>	<i>Title</i>
39.22	Meskendahl (2010)	The influence of business strategy on project portfolio management and its success: a conceptual framework.
33	Beringer et al. (2013)	Behaviour of internal stakeholders in project portfolio management and its impact on success.
30.5	Martinsuo (2013)	Project portfolio management in practice and in context.
27.5	Kaiser et al. (2015)	Successful project portfolio management beyond project selection techniques: understanding the role of structural alignment.
24.57	Unger et al. (2012)	The three roles of a project portfolio management office: their impact on portfolio management execution and success.
24.14	Killen et al. (2012)	Advancing project and portfolio management research: applying strategic management theories.
23.33	Jonas (2010)	Empowering project portfolio managers: how management involvement impacts project portfolio management performance.
21.57	Teller et al. (2012)	Formalisation of project portfolio management: the moderating role of project portfolio complexity.
18.43	Heising (2012)	The integration of ideation and project portfolio management: a key factor for sustainable success.
18.17	Teller and Kock (2013)	An empirical investigation on how portfolio risk management influences project portfolio success.
16.5	Costantino et al. (2015)	Project selection in project portfolio management: an artificial neural network model based on critical success factors.
15	Brook and Pagnanelli (2014)	Integrating sustainability into innovation project portfolio management: a strategic perspective.
14.67	Teller (2013)	Portfolio risk management and its contribution to project portfolio success: an investigation of organisation, process, and culture.
12.33	Jonas et al. (2013)	Predicting project portfolio success by measuring management quality: a longitudinal study.
11.57	Voss (2012)	Impact of customer integration on project portfolio management and its success: developing a conceptual framework.
11.2	Daniel et al. (2014)	A dynamic capabilities perspective of IS project portfolio management.

Table A1 Articles analysed in the systematic review for PPM practices (continued)

<i>Cites/year</i>	<i>Authors</i>	<i>Title</i>
10.14	Beringer et al. (2012)	Establishing project portfolio management: an exploratory analysis of the influence of internal stakeholders' interactions.
9.44	Laslo (2010)	Project portfolio management: an integrated method for resource planning and scheduling to minimise planning/scheduling-dependent expenses.
8.83	Killen and Hunt (2010)	Robust project portfolio management: capability evolution and maturity.
8.67	Killen and Hunt (2013)	Dynamic capability through project portfolio management in service and manufacturing industries.
8.2	Gutiérrez and Magnusson (2014)	Dealing with legitimacy: a key challenge for project portfolio management decision-makers.
7.33	Siew (2016)	Integrating sustainability into construction project portfolio management.
7.33	Young and Conboy (2013)	Contemporary project portfolio management: reflections on the development of an Australian competency standard for project portfolio management.
7.2	Korhonen et al. (2014)	Management control of project portfolio uncertainty: a managerial role perspective.
5	Pajares and López (2014)	New methodological approaches to project portfolio management: the role of interactions within projects and portfolios.
4.33	Lerch and Spieth (2013)	Innovation project portfolio management: a qualitative analysis.
4	LaBrosse (2010)	Project-portfolio management.
3.6	Hyväri (2014)	Project portfolio management in a company strategy implementation, a case study.
3.5	Rank et al. (2015)	Preparedness for the future in project portfolio management: the roles of proactiveness, riskiness and willingness to cannibalise.
3.43	Frey and Buxmann (2011)	IT project portfolio management – a structured literature review.
2	Frey and Buxmann (2012)	The importance of governance structures in IT project portfolio management.

Appendix B**Table B2** Code distribution in PPM articles

<i>No.</i>	<i>Authors</i>	<i>Code family distribution</i>		<i>Code distribution</i>	
1	Pajares and López (2014)	8	89%	19	51%
2	Korhonen et al. (2014)	7	78%	14	38%
3	Young and Conboy (2013)	7	78%	17	46%
4	Siew (2016)	3	33%	5	14%
5	Gutiérrez and Magnusson (2014)	7	78%	19	51%
6	Killen and Hunt (2010)	4	44%	7	19%
7	Killen and Hunt (2013)	8	89%	24	65%
8	Laslo (2010)	2	22%	6	16%
9	Beringer et al. (2012)	8	89%	21	57%
10	Daniel et al. (2014)	8	89%	24	65%
11	Voss (2012)	9	100%	29	78%
12	Jonas et al. (2013)	9	100%	31	84%
13	Teller (2013)	7	78%	20	54%
14	Brook and Pagnanelli (2014)	7	78%	15	41%
15	Costantino et al. 2015	8	89%	19	51%
16	Teller and Kock (2013)	8	89%	20	54%
17	Heising (2012)	7	78%	22	59%
18	Teller et al. (2012)	9	100%	32	86%
19	Jonas (2010)	9	100%	30	81%
20	Killen et al. (2012)	5	56%	14	38%
21	Unger et al. (2012)	8	89%	24	65%
22	Kaiser et al. (2015)	7	78%	20	54%
23	Martinsuo (2013)	9	100%	27	73%
24	Beringer et al. (2013)	8	89%	28	76%
25	Meskendahl (2010)	8	89%	23	62%
26	Frey and Buxmann (2011)	3	33%	7	19%
27	Frey and Buxmann (2012)	7	78%	8	22%
28	Rank et al. (2015)	7	78%	13	35%
29	Hyväri (2014)	5	56%	8	22%
30	LaBrosse (2010)	9	100%	25	68%
31	Lerch and Spieth (2013)	8	89%	19	51%