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The impact of project portfolio management on information technology projects

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Abstract

The ever-increasing penetration of projects as a way to organise work in many organisations necessitates effective management of multiple projects. This has resulted in a greater interest in the processes of project portfolio management (PPM), with more and more software tools being developed to assist and automate the process. Much of the early work on PPM concentrated on the management of IT projects, largely from the perspective of the management of resources and risk. Many of the recent articles have been by vendors of the software, promoting the value of the PPM process. However, the claims made in those articles are typically only supported by anecdotal evidence. In this paper, we assess whether there is a correspondence between the use of PPM processes and techniques, and improvements in the performance of projects and portfolios of projects. Based on our findings, we introduce a three-stage classification scheme of PPM adoption, and present a strong correlation between (1) increasing adoption of PPM processes and a reduction in project related problems, and (2) between PPM adoption and project performance.

Keywords: Project portfolio management; Managing programmes; Process, procedures; Information technology

1. Introduction

Recently, information technology (IT) has moved beyond the implementation of IT applications to an age of IT-enabled change. The trend towards increasing use of IT continues and the challenge remains how to better manage IT projects in order to maximise their economic benefits. Part of that challenge can be tackled by "doing projects right" and part by "doing the right projects" [1]. While Project Management concentrates primarily on the former, Project Portfolio Management, hereafter referred to as PPM, is focussed on the latter. Contrary to Project Management, which focuses on single project, and Programme Management, which concerns the management of a set of projects that are related by sharing a common objective or client, or that are related through interdependencies or common resources, PPM considers the entire portfolio of projects a company is engaged in, in order to make decisions in terms of which projects are to be given priority, and which projects are to be added to or removed from the portfolio (see also Lycett et al. [2]).

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PPM has largely developed around the following elements: providing a centralised view of all the projects in an organisation, enabling a financial and risk analysis of projects, modelling interdependencies between a family of projects, incorporating constraints on resources shared between projects, enabling prioritisation and selection of projects, ensuring accountability and governance at the portfolio level, allowing for portfolio optimisation and providing support in the form of standardised processes and software tools.

However, despite the relatively extensive literature on PPM (see Sections 2 and 3), evidence of its value has been rather anecdotal. It is unclear whether there are specific PPM elements that add more value than others or indeed, whether they add value at all. It is for these reasons that we decided to investigate the potential for increasing business value through the application of PPM techniques to IT projects.

The first contribution of this paper is the development of a classification scheme for the adoption level of PPM across a diversity of organizations. Secondly, we identify the impact of the PPM adoption level on project performance by investigating the correspondence between the adoption level and reported project-related problems on the one hand and observed positive elements in projects on the other. Finally, we suggest a phased implementation process for the adoption of PPM and describe the challenges that organisations might face in each phase.

The paper is organized as follows. Sections 2 and 3 contain a literature review of the theories, models and processes presented for PPM, reviewed according to a historic and a thematic perspective. The historic perspective provides a view of how the field has developed over time, while the thematic perspective summarizes the main themes identified in the literature. Section 4 describes the objectives and hypotheses of this study, as well as the methodology used, with the general results presented in Section 5. In Section 6, we present a classification for adoption levels of PPM and in Section 7 we investigate the impact of PPM and project performance, highlighting the managerial implications of this analysis. In Section 8, we provide a phased implementation plan. Section 9 contains a summary and our conclusions.

2. Literature review: a historic perspective

The field of portfolio management owes its origins to a seminal paper written in 1952, in which Harry Markowitz [3] laid down the basis for the Modern Portfolio Theory (MPT). MPT allows to determine the specific mix of investments generating the highest return for a given level of risk. Whereas MPT was initially developed for financial investments, in 1981, McFarlan [4] provided the basis for the modern field of PPM for IT projects. According to McFarlan, management should also employ a risk-based approach to the selection and management of IT project portfolios. He observed that risk-unbalanced portfolios could lead an organization to suffer operational disruptions, or leave gaps for competitors to step in.

In 1992, Wheelwright and Clark [5] developed a framework for categorising projects that they called the Aggregate Project Plan. This plan allows for an overview of the project portfolio along two dimensions, (1) the extent of changes made to the product, and (2) the degree of process change, leading to four categories of projects (in increasing order of change): derivative projects, platform projects, breakthrough projects and R&D projects (for complete definitions see [5]). This framework can be used to identify gaps in the portfolio, or potential resource shortages.

In the mid-1990s, the field of PPM received increasing attention. In 1994, a GAO report [6] described a successful company that used portfolio investment techniques to manage its IT projects. The organisation developed a set of criteria to evaluate benefits, costs and risks and thus determined the best mix of projects for obtaining a better balance between maintenance and strategic initiatives. As a result, in three years, the organization reported a 14-fold increase in the return on investment from IT projects.

In 1998, Thorp published the "Information Paradox" [7], putting PPM in a broader framework called "Benefits Realization". According to the author, PPM techniques are fundamental for getting value from IT projects.

In a recent publication, Jeffery and Leliveld [8] report the results of a survey with 130 senior executives, 90% of whom were CIOs. The survey identified, among other things, that 25% of the respondents could be defined as optimally applying Information Technology Portfolio Management (ITPM), 45% as having or adopting it and 78% as planning to have or to keep it.

3. Literature review: a thematic perspective

In this section, we review the main themes around which research on PPM has been developed, namely the PPM objectives and scope, the pre-conditions for PPM, the key elements of PPM, the impact on organisations and the problems within organizations associated with a lack of PPM processes.

PPM objectives and scope. The majority of the literature in the PPM field provides similar lists of objectives to be achieved through the adoption of PPM approaches. Five main goals dominate the literature [9–11], namely (1) defining goals and objectives, i.e., clearly articulating what the portfolio is expected to achieve, (2) understanding, accepting, and making trade-offs, (3) identifying, eliminating, minimizing and

diversifying risk, (4) monitoring portfolio performance, i.e., understanding the progress that portfolio is making towards the achievement of the goals and objectives, and (5) establishing confidence in achieving a desired objective.

Pre-conditions for PPM. Several papers discuss the pre-conditions that organisations should take into account, when adopting PPM approaches:

- *Organisational strategy*: Organisations should have clear strategic imperatives in place, properly communicated across all departments, to which the PPM goals are to be aligned to [2]. Matheson and Matheson [11], for example, describe a firm that designed a task force to develop a strategy for its lacklustre R&D Portfolio, but soon found this to be in vain since the company lacked a business strategy in the first place.
- *Business leaders' involvement*: Another pre-condition for the adoption of PPM approaches is the involvement of top executives who should be able to take a less siloed view of the portfolio. As Kendall and Rollins [12] highlight, without the full understanding and support of top executives the constant fight over resources and reprioritisations will never be resolved.
- *Team skills*: Another relevant aspect is the importance of having a project team with relevant finance and strategy skills. Although most IT professionals have sufficient knowledge to calculate the net present value (NPV) or return on investment (ROI) of a project, as Jeffery and Leliveld [8] noticed, to build a proper business case for a project, the team must understand the assumptions behind those calculations, analyse the sensitivity of these results and evaluate the risks that might impact project returns.

Key elements in PPM. Other papers discuss the key elements that constitute PPM:

- *Centralised view of the project portfolio*: Widely emphasised in the literature is the need for a centralised view of the organisation's projects [12]. The first step in the adoption of PPM approaches requires the preparation of an inventory of current and proposed projects, preferably through a central area responsible for collecting, analysing and distributing project information in a common format.
- *Financial Analysis*: While finance professionals have worked for decades with metrics to capture return and risk of assets, the use of these methods for IT projects still seems uncommon for many organisations [8]. Nonetheless, several techniques have been created to properly measure the financial value of projects (see Benaroch [13], and McGrath and MacMillan [14]). Most importantly, however, one should choose a valuation methodology, be it return on investment (ROI), internal rate of return (IRR), net present value (NPV) or economic value added (EVA), and consistently apply it.
- *Risk analysis*: McFarlan, [4, p. 142], noted that two of the main reasons for project failure were "the failure to assess individual project risk and the failure to consider the aggregate risk of the portfolio of projects". In addition, as observed by Markowitz [3], a portfolio should not be chosen considering only individual characteristics of the investments, but it should be built based on the overall risk and reward of the portfolio. When investment interactions are considered, one can create portfolios with the same expected return but lower risk than when not taking into account the interactions.
- *Interdependencies*: Thorp [7] noticed that one advantage of PPM is its ability to reduce inter-program competition for resources and to turn program overlaps into productive interdependencies. He identified the following types of interdependencies: sequential dependencies, overlapping outcomes, competition for scarce resources, and change bottlenecks.
- *Prioritisation, alignment and selection*: The selection of projects to compose a portfolio should ensure that all areas of the organisation's strategy are properly addressed and that the portfolio is well balanced [15]. When properly combining portfolio alignment and balance, organisations should come up with a very clear picture of which projects should be cut off and which ones should be funded.
- *Constraints*: Goldman [15] highlights that incorporating constraints is a key step in the portfolio alignment process. Four types of constraints should be managed: scarce human resources, staff capabilities, budgets and infrastructure.
- *Dynamic re-assessment of the portfolio*: Jeffery and Leliveld [8] mention that only 26% of the respondents in their survey track financial measures after an investment is made. As a result, managers ignore options embedded in the portfolio, which would have allowed them either to abandon unprofitable projects before further investments are made, or to expand successful investments.
- *Need for specialized software*: The need for specialized software for PPM is a controversial issue in the literature. Some believe that there is no need at all, whereas others claim that besides working as a process change catalyst, specialised software is indispensable due to the time consuming process of updating all information needed for the decision making process. Due to the growing number of available software tools, several reports have been issued that evaluate the best software available in the market according to several dimensions (see e.g. [16]).

Impact on organisations. Datz [17] provides a summary of the main benefits organisations should expect from adopting PPM approaches. These include: (1) maximizing the value of IT investments while minimizing risk, (2) improving communication and alignment between IT and business leaders, and (3) encouraging business leaders to act as team players, allowing planners to allocate resources more efficiently and to terminate projects.

Problems within organisations. Kendall and Rollins [12] list four generic problems associated with a lack of PPM processes and tools: (1) too many active projects, (2) projects that do not add value, (3) projects not linked to strategic goals, and (4) an unbalanced portfolio. Other typical problems [18] include a lack of coordination between projects, conflicting project objectives, unexpected resource bottlenecks, late delivery of projects, lack of commitment from business leaders, lack of cross-functional working, disappointment with final project benefits, and resistance to organisational change.

4. Methodology and hypotheses

There seems to be an agreement among experts that organisations are in different stages of the adoption of PPM approaches, even when organisations do not explicitly and formally adopt them. Berinato [19] believes that there are 5 levels of PPM adoption from the simplest to the more complex:

1. Put all projects in one database.
2. Prioritise the projects in the database.
3. Divide the projects into two or three budgets based on type of investment.
4. Automate the repository.
5. Apply Modern Portfolio Theory.

Yet, according to the same author, benefits could be achieved at every level. At level 1, for example, the project overview allows spotting redundancies. At level 2, prioritization allows for an improvement in the relationship between business leaders and IT people, since the projects are seen as investments with economic value. At level 3, by separating projects by type, organisations can apply a more appropriate set of criteria to each type of investments, facilitating the prioritisation and selection process. At level 4, one of the main benefits is to ensure that information will be updated when needed without people spending too much time collecting it. Finally, level 5 provides a better balance between risk and reward.

Jeffery and Leliveld [8] propose a similar framework comprised of three stages:

1. *Defined*: Organisations in this stage have defined and documented the key components of the IT portfolio and have high-level estimates of costs and benefits for each element. The IT department prioritises projects and has central budget oversight.
2. *Managed*: Organisations in this stage have periodic portfolio reviews with quantified and financial investment measures. Project data is codified and logged in a central database. New initiatives are screened, categorised and prioritised.
3. *Optimised*: Organisation in this stage distinguish themselves by the ability to balance and optimise their IT project portfolio. They are disciplined in getting feedback from business leaders and use financial valuation techniques such as Real Option Analysis (for full definition see [20] and [21]).

Based on a survey, we developed a new framework of PPM adoption and identified groups of organisations at different stages of the adoption of PPM. We also correlated the PPM adoption level to the benefits the organisations perceived and to the level of problems they face in managing their projects. We used an approach similar to the one adopted by Ibbs and Regato [22], who showed that there is a positive relation between the level of adoption of project management techniques and improvements in cost and schedule performance in projects. We extended this methodology to PPM. The aim of the research is to investigate the extent to which organisations view their internal projects as discrete projects or as a coherent portfolio of investments, and the value they get from taking this perspective. We examined two hypotheses:

Hypothesis 1. The adoption level of PPM processes and techniques varies across organisations, allowing for classification of organisations according to their level of adoption. In addition, the PPM processes and techniques adopted by organisations having a higher adoption level are supersets in that they comprise the processes and techniques also adopted by organisations in lower categories, but also include more enhanced processes and methods.

Hypothesis 2. Higher adoption levels of PPM methods and techniques result in fewer project related problems, and increased value gained from information technology projects.

In order to test the hypotheses stated above we designed a survey with 5 sections. Section 1 collects demographic information from the respondents. Section 2 is designed to solicit information about the PPM adoption level of each organisation, and is developed around the main elements that are part of the

PPM approach, namely a centralised view of projects, financial analysis, risk analysis, interdependencies, constraints, overall analysis at portfolio level, prioritisation, selection, accountability and governance, optimisation and specialized software. The majority of the questions in this section were closed questions with a scale from 1 (''don't have any or don't plan to have'') to 5 (''Always use''). Section 3 provides respondents with a set of issues commonly identified in the literature as associated to the lack of PPM. The scale adopted is the same as Section 2 (1–5 scale with 1 being ''not at all'' and 5 being ''to a great extent''). Section 4 provides respondents with a list of PPM approaches with a question whether they had implemented them and if yes, what had been the impact in their organisation. The scale used in this section to represent a negative vs. positive impact is from −2 (''significant negative impact'') to +2 (''Significant positive impact''), with two extra options ''do not use'' and ''use but too early to assess''. The questions in Sections 3 and 4 serve as proxies for the return on investment of the projects in the IT portfolio, where we expect to see a negative correlation between the PPM adoption level and the problems experienced, and a positive correlation between the adoption level and the positive effects observed. Finally, Section 5 solicits the challenges that companies faced in the implementation of PPM. Here a 1–5 scale is used, 1 representing ''not at all'' and 5 ''to a great extent''. Note that since the survey is self-assessment based, the results are subjective, which may affect the validity of the analysis and conclusions. See Appendix A for a small sample of the survey questions. The full survey is available upon request.

An online survey was sent to 125 companies, either through existing contacts or via existing agreements[3]. Of these, we received 31 responses, a response rate of 25%. In addition, a mass mailing of 350 emails was sent to IT departments within public organisations. In this case the response rate was disappointing, since only 3 responses came from this source, a 1% response rate, probably due to the fact that the survey never reached an appropriate person in the organisation. Our results therefore focus on the sample obtained from the 125 companies with which we already had contacts.

The sample includes medium and big organisations with turnover varying from less than £100 million (19%) to more than £15 billion (4%). The number of employees varies from less than 1500 (21%) to more than 100,000 (6%). The majority of the respondents are from the IT sector (55%), with others from Business Operations (15%), General Management (15%), Strategy (12%) and Finance (3%). Geographically, the respondents are predominantly from the UK (40%), with Europe accounting for 15% and the rest of the world for 45%.

Using the terminology of Turner and Cochrane [23], we can classify the majority of projects these firms are engaged in as either type 2 or type 3 projects.

[3] Existing agreements include the Impact Programme and Prog-M branch of the Association for Project Management. For details of their activities see www.impact-sharing.com and www.apm.org.uk respectively.

5. Adoption of PPM processes: key results

Our main findings in terms of PPM adoption include the following:

Centralised view. The vast majority of the respondents have a centralised view of its projects and have a central point responsible for collecting, analysing and distributing information:

- 93% have an inventory of current and proposed significant projects and 100% of the organisations that do not have it plan to have it in the future;
- 79% claim that they have a central point responsible for collecting, analysing and distributing information regarding the portfolio of projects and 71% of the organisations that do not have one plan to have in the future.

Financial analysis. Our research identified that almost all respondents use at least one technique to calculate the financial worth of its projects, with Payback being the most common (93%) and EVA the least common (31%).

Risk analysis. The results of our survey show that the complexity of projects and technological risks are the main types of risks monitored by most organisations:

- Approximately 92% evaluate the complexity of projects, including technology risks, cash flow and organisational changes.
- Approximately 80% evaluate team expertise, market and environmental risks and management commitment.
- 83% who do not evaluate team expertise intend to do so in the future and 80% who do not evaluate environmental risks intend to do so in the future.

Interdependencies. We found that 84% of the respondents take into account project interdependencies. 85% look at cross-project dependencies while 82% considers implementation bottlenecks.

Constraints at portfolio level. Among the firms surveyed, budget and financial constraints are widely and frequently taken into account, 91% of the respondents consider them, including 83% who observe them frequently or always. We also noted that 100% of the

Table 1
PPM elements that organisation plan to implement

	PPM elements	Already use (%)	Plan to use (%)
Centralised view	Have and inventory of current and proposed significant projects	93	7
Financial analysis	Use payback	93	0
	Use ROI	85	3
	Use NPV	68	16
	Use IRR	65	18
	Use of economic value added (EVA)	31	28
	Use real options	37	14
Risk analysis	Evaluate complexity of the project, including technology risks, cash flow and organisational changes	92	8
	Evaluate team expertise, market and environmental risks and management commitment	80	17
	Management of overall risk analysis of project portfolio	62	35
Interdependencies	Take into account project interdependencies, divided occasionally, frequently or always in similar proportions	84	N/A
	Considers implementation bottlenecks	82	N/A
Constraints at portfolio level	Budget and financial constraints are taken into account	91	9
	Evaluation of staff capabilities to implement projects	74	26
Overall analysis	Management of project diversification	33	33
	Management of risk vs. reward analysis of project portfolio	59	32
	Management of the financial analysis of project portfolio	74	21
Categorisation, selection, accountability and governance	Use categorisation to balance project mix;	47	N/A
	Align the project portfolio with organisation's strategy and with organisation's IT architecture	82	N/A
	Have top management involved	91	N/A
	Have business leaders accountable;	85	N/A
	Use of regular project portfolio reporting	79	21
Optimisation	Centrally tracking of the benefits of projects	50	41
	Comparison of outcome of projects with their original targets	68	32
	Analysis of the impact of individual new projects to the overall portfolio	62	35
	Annually (or more frequently) prioritisation of the overall project portfolio	76	21
	Regularly review and revision of the project portfolio	71	24
Specialized software	Use of specialized software to manage portfolio of projects	29	47

respondents who do not yet consider these constraints, plan to do so in the future.

Overall analysis at portfolio level. Our research identified that an overall analysis at the portfolio level is not widely implemented. Only 33% confirm examining diversification to reduce portfolio risk, while 59% analyse risk-reward at the portfolio level;

Categorisation, selection accountability and governance. The results show that the categorisation of projects does not seem to be a common practice among respondents; 47% use categorisation to balance project mix. On the other hand, accountability and strategic alignment seems to be high and increasing; about 82% align the project portfolio with the organisation's strategy and IT architecture, and consider the customer impact of project portfolio results.

Specialized software. Only 30% of the respondents use specialized software to manage their portfolio of projects; of those who do not use any, 67% intend to use in the future.

The survey results for Section 2 of the survey (PPM adoption) are summarized in Table 1.

6. A classification on the adoption of project portfolio management

We grouped the organisations with different levels of PPM adoption using cluster analysis, a multivariate statistical methodology that classifies elements into relatively homogenous groups, minimizing the variance in use of PPM approaches within the groups and maximizing the variance across the groups. Using SPSS, a *k*-means cluster analysis with Ward's method [24] was performed. As the solution depends on the

Table 2
Adoption level analysis per stage

PPM elements	Stage I	Stage II	Stage III
Centralisation of project control	Most organisations have an inventory of projects and frequently use it, but project control is largely decentralised	Frequently have a central point responsible for collecting, analysing and distributing project information in a common format	Almost always have a central point to control projects, which is extensively used
Financial analysis	Some financial analysis is undertaken with special attention to Payback Period and ROI	Financial tools are frequently used to evaluate projects. The most utilised are ROI, Payback period, NPV and IRR	The financial analysis is always done. Several tools are frequently used
Risk analysis	Occasionally risks are evaluated. In most cases the attentions is in financing/cash flow risks	All aspects of risks are to some extent considered. Most of the focus is in the complexity of the project and technology risk	An extensive risk analysis is performed. Attention is devoted to project complexity, technological risks, team experience and cash flow risks
Interdependencies	Some consideration of overlaps and duplication of project results	Cross-project dependencies and implementation bottlenecks are frequently considered	Interdependencies are frequently managed. Significant attention given to cross-project dependencies
Constraints	Little constraint analysis. The only exception is the control of the budget/financial capacity	Frequently evaluate budget/financial capacity and competition for scarce resources. Other constraints, such as, staff capabilities to implement projects are occasionally evaluated	Budget/financial capacity constraints are always evaluated. Other aspects such as staff capabilities and competition for scarce resources are frequently managed
Overall portfolio analysis	Very little analysis at the portfolio level	More concern about portfolio analysis. The portfolio financial analysis is frequently managed and risk vs. reward evaluation is occasionally undertaken	Almost always the portfolio is evaluated in terms of overall risk and financial value. Frequently portfolio diversification is considered
Categorisation, selection, accountability and governance	Occasionally have top management involved in project selection. Also some effort is spent in aligning the project portfolio to the organisation's strategy	More attention is devoted to the project portfolio alignment to strategy and IT structure. Also, there is frequent involvement of top management in the project selection process	Significant alignment of the portfolio to the organisation's strategy. Systematic review of projects at specific stages. Top management frequently involved in the project selection process and business leaders are accountable for project results
Optimisation	Very few processes to optimise the portfolio are in place. Some effort is spent in generating regular project portfolio reporting	Frequently have regular project portfolio reporting and annually, or more frequently, the overall project portfolio is prioritised	In general, processes to optimise the portfolio are frequently applied. Project outcomes are always compared with the original targets and project benefits are frequently centrally tracked
Specialised software	Not used	Occasionally use specialised software to manage the project portfolio	Use is more frequent than in the Stage II, but it is still occasionally employed
Overall adoption level[a]	1.63	2.59	3.52

[a] Overall adoption level is calculated as the average response level whereby the scale is: 1, do not use; 2, use occasionally; 3, frequently use; 4, always use.

initial partition of the data, the analysis was repeated several times with different starting values. The ANOVA analysis rejected the hypothesis, at a 95% confidence level, that there was no significant difference among the cluster-specific means. The best quantitative and qualitative results were attained splitting our sample in three groups. Within each cluster, the adoption was measured using a scale from 1 (''do not use'') to 4 (''always use'')[4]. The level of adoption

[4] The level of adoption of PPM in this classification refers to current situation. Hence, survey answers ''do not use and do not plan to use'' and ''do not use but plan to use'' represent the same current level ''do not use''.

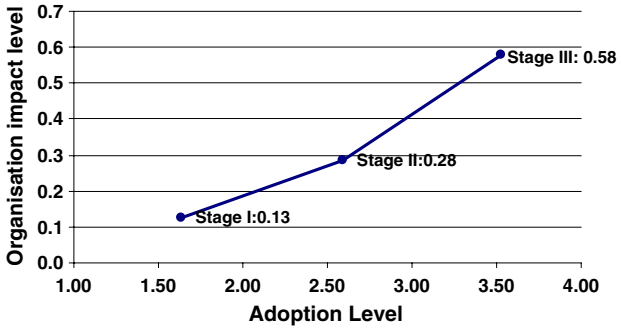


Fig. 1. Impact per stage of PPM adoption. (I) Adoption level scale: (1) do not use; (2) use occasionally; (3) frequently use; (4) always use. (II) Organisation impact level scale: −1, significant negative impact; 0, no impact; +1, significant positive impact.

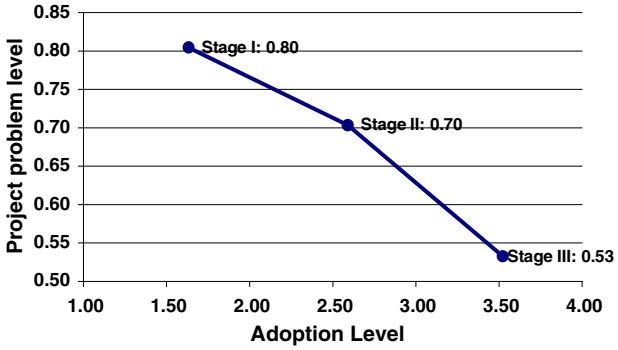


Fig. 2. Level of project problems per stage of PPM adoption. (I) Adoption level scale: (1) Do not use; (2) Use occasionally; (3) Frequently use; (4) Always use. (II) Project problem level scale: (0) Do not have problems; (1) Have problems to a great extent.

of PPM elements for each cluster was quantified by averaging the respondents' scores to all questions. See Appendix B for the detailed scores. After having defined the groups and quantified their level of use of PPM techniques, we studied each group in order to understand how they differ from each other. The conclusions appear in Table 2 below.

7. The impact of project portfolio management

Once groups were identified and scores quantified, an analysis of the impact of different levels of adoption of PPM in organisations was performed.

Level of adoption vs. organisational impact. To verify that the incremental use of PPM methods has a positive impact in organisations, we studied each groups' answers to the questions in the survey's fourth section and compared them to groups' average levels of adoption of PPM previously identified in the cluster analysis. Fig. 1 clearly demonstrates a significant positive relationship between the level of adoption and the impact generated.

Four aspects appeared to most organisations as factors of greatest positive impact. First, the return of what should be the first step of any PPM implementation was extremely valued by almost all respondents: 90% of the managers who maintain an inventory of projects claimed that the practice has been responsible for a positive impact. Second, 88% of the respondents who align the project portfolio to a clear statement of the organisation's objective said that this process has positively impacted their organisation. Among those 52% noted a significant positive impact. Third, the consolidation of information about projects and the standardization of project analysis improved the performance of 89% of the respondents that implemented it. Fourth and finally, among the organisations that explicitly considered project interdependencies, 86% of them stressed the positive return obtained by the process, with 43% claiming significant success.

Level of adoption vs. level of problems with projects. We also identified the relationship between the use of PPM processes and the level of problems associated with the lack of PPM approaches in organisations. Section 3 of the survey was used to calculate the groups' averages level of problems and again a strong relationship, this time negative, between the use of PPM techniques and level of problems was identified, as can be seen in Fig. 2.

The analysis of the three clusters identified in our study showed that the groups were not only different in terms of number of PPM elements adopted but also in the intensity in which those were used. Also, the study of how the use of PPM has impacted organisations and changed the level of project related problems allows answering our second hypothesis. First, the results show that organisations, in general, see projects collectively and apply portfolio management processes. However, they adopt these methods with different intensities. Organisations at stage I, for example, scored 1.22 in the survey sub-section related to analysis at portfolio level while respondents at stages II and III scored 2.03 and 3.37, respectively. Second, it is clear that the return from PPM methods is reduced when some PPM approaches are not adopted. As Fig. 1 shows, organisations at stage I obtained less impact from the implementation of PPM elements (0.13 in a scale from −1 to 1), than stage II (0.28) or stage III (0.58) organisations. This means that as organisations increasingly adopt PPM approaches, the impact is strengthened. Third, the use of PPM techniques not only positively impacts organisations but also reduces the level of project related problems. As Fig. 2 shows, organisations at stage I found a significantly higher (0.80) level of problems than stage II (0.70) and stage III (0.53) organisations. Fig. 3 provides an additional perspective on the difference between the stages by mapping the main project issues, and their degree of severity, to the different adoption stages.

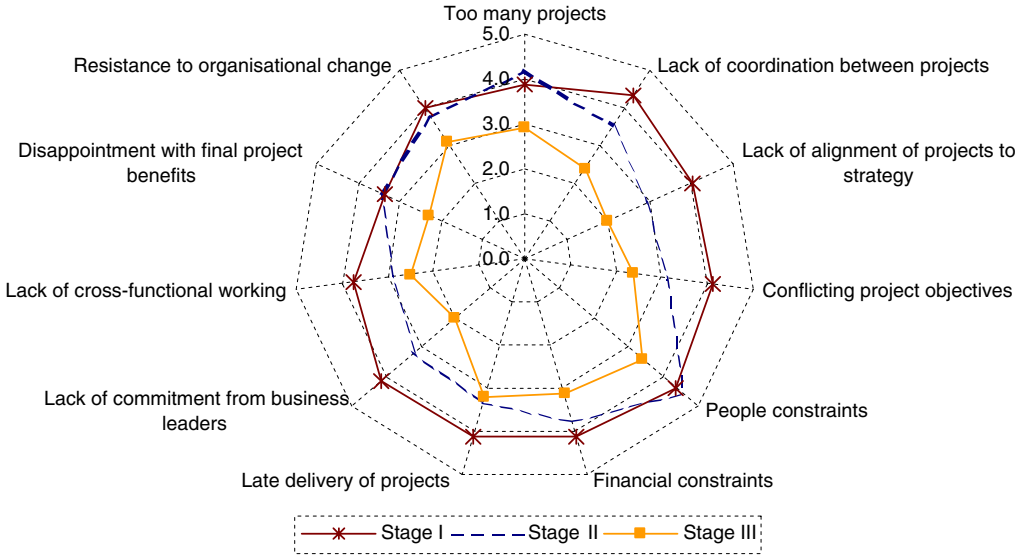


Fig. 3. Map of project issues per stage.

8. A phased implementation plan for PPM

Based on the different PPM adoption stages and the resulting benefits, we have developed a phased implementation plan for PPM. This plan is centred around the elements having the biggest impact in organisations in each stage, the issues managers currently face, and the challenges these organisations face while implementing these PPM processes. We elaborate on the proposed three-stage PPM implementation plan below.

8.1. Stage I: portfolio inventory

In this stage, the following PPM processes are to be installed:

- Centralised project administration.
- Risk evaluation procedures.
- Explicit incorporation of resource constraints.
- Increasing business leaders' accountability for project results.

Our study indicated that the greatest positive impact of PPM can be observed when organisations start to (a) assess economic and technological risks at the portfolio level, (b) incorporate resource constraints in their decision making, and (c) explicitly look for risk diversification across the portfolio. Nevertheless, according to our respondents, such organisations still face issues in terms of lack of commitment from business leaders, lack of alignment of projects to strategy, lack of coordination between projects and conflicting project objectives. Therefore, it was not a surprise to identify that, according to the managers of these organisations, one of the greatest challenges to advance the implementation of PPM is the lack of a clear company strategy. They also understand that their teams typically lack relevant training and appropriate knowledge to measure projects benefits, which can explain the low impact of PPM in improving their assessment of financial worth of the project portfolio.

8.2. Stage II: portfolio administration

In this stage, the following PPM processes are to be installed:

- Project categorisation.
- Evaluation of customer impact of the project portfolio results.

Organisations at this stage have better defined objectives and are better informed about the costs and benefits of their projects. Two aspects are especially important for creating additional benefits from PPM, namely (1) processes to categorise projects and (2) better evaluation of customer impact of the project portfolio results. However, a large part of respondents of this group also said that they lack resources to analyse project data, suffered from people and financial constraints as well as an overload of projects.

As organisations evolved from stage I to II, they still encounter the same level of problems with excessive number of projects and people constraints, as seen in Fig. 4. These organisations also cited lack of resources, lack of appropriate ways of measuring project benefits and high staff turnover as the main challenges to further implement PPM.

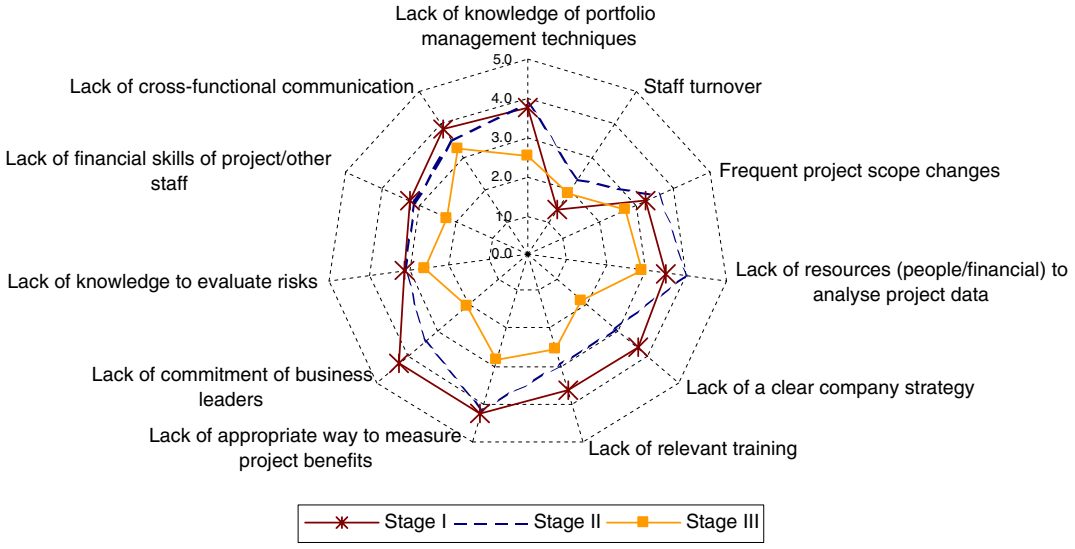


Fig. 4. Map of PPM challenges per stage.

8.3. Stage III: portfolio optimisation

In this stage, the following PPM processes are to be installed:

- A project portfolio committee.
- Assessment of the financial worth of the portfolio.
- Management of project interdependencies.
- Tracking project benefits.

The most optimistic findings came from stage III organizations. The respondents in this stage claimed that almost all aspects of PPM had significantly increased the return on investment in projects. Among the top of the list it is observed the importance of a project portfolio committee. 45% of these companies have a committee composed by top management and 56% composed of senior general management. This stresses the importance of top executives managing the portfolio. Also, 89% of these committees meet at least once a month.

Moreover, it is relevant to notice how strongly these organisations think about investments at the portfolio level. Respondents at this stage devoted high importance to the management of project interdependencies, alignment of the project portfolio with the organisation's objectives and assessment of the financial worth of the portfolio. Interestingly, this group was the only one that obtained a fair return from the effort of the use of PPM software. This reinforces the thesis that the use of PPM software is only justifiable when the other aspects of PPM are already in place.

Although the level of project-related problems for organisations in this stage is typically lower than at other stages, managers of organisations at stage III said that they still have problems with people and financial constraints and late delivery of projects that are correlated with high number of changes in project scope and lack of cross-functional communication and work, as highlighted in Fig. 4 above.

9. Conclusions

Based on a survey of 34 medium-to large-size companies from the UK, Europe and the rest of the world, we developed a framework for the adoption of Project Portfolio Management (PPM) processes at organisations. Using a cluster analysis, we identified three stages of PPM adoption, and investigated which of the elements of PPM are typically present in the organisations at the different adoption levels, including a centralised view of projects, financial analysis, risk analysis, managing interdependencies, incorporating constraints, enabling an overall analysis at portfolio level, project prioritisation and selection, and the use of specialized software tools.

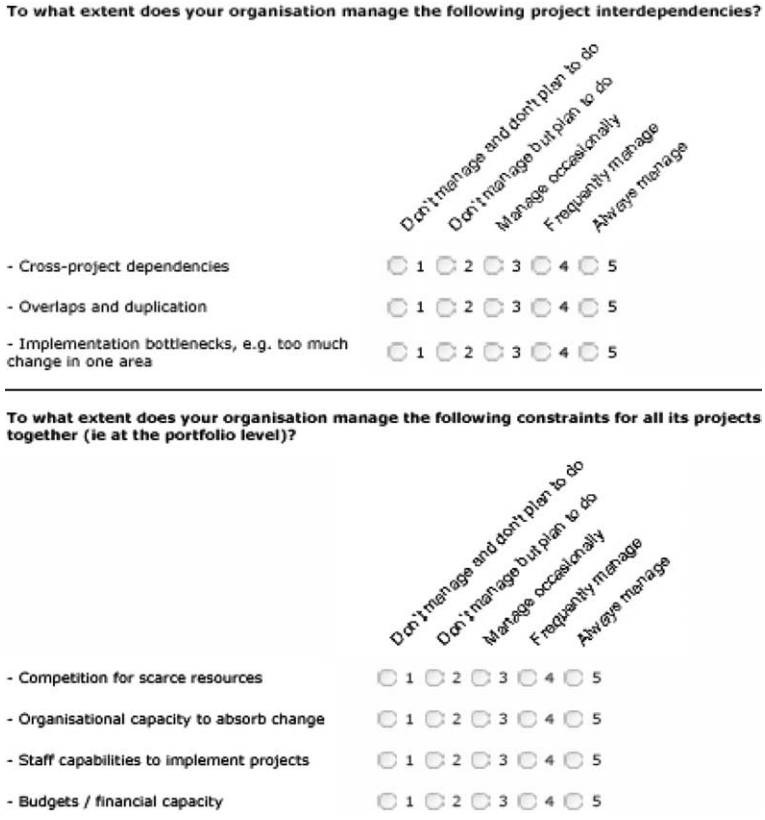
We correlated the PPM adoption level to the benefits the organisations perceived and to the level of problems they face in managing their projects, and showed that an increased PPM adoption level has a significant positive impact on the return on the projects in the portfolio, and a significant negative impact on the number of project-related problems reported.

We also provide a phased implementation plan for organisations to evolve through three stages of PPM adoption: from Portfolio Inventory through Portfolio Administration to Portfolio Optimisation

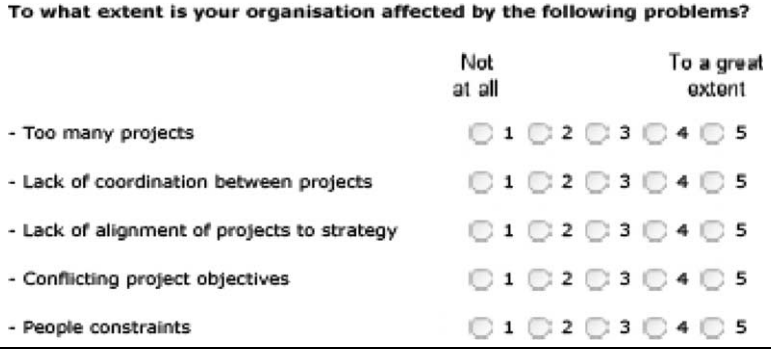
with increasing positive impact, both reducing the organisational problems associated with projects and enhancing return on investment. However, we have also shown that organisations do not have to implement all the elements of PPM to create benefits. Even organisations at stage I benefited from the few PPM elements they had implemented. According to our results, value could be enhanced by properly choosing the right elements to adopt. For example, our results showed that implementing specialised project portfolio management software will not add any value unless all other major processes have also been adopted, and therefore only make sense for organisations at stage III of PPM adoption.

Appendix A. Sample of survey questions

Section 2: Projects and portfolio management in your organisation



Section 3: Issues associated with projects



Section 4: Impact of using project portfolio management

What has been the impact (positive or negative) of using the following in your organisation?

	Significant negative impact		No impact		Significant positive impact	Do not use	Use but too early to assess
- An inventory of projects	-2	-1	0	+1	+2		
- More centralized project control	-2	-1	0	+1	+2		
- A process to categorize projects	-2	-1	0	+1	+2		
- Rigorous assessment of the financial worth of the project portfolio	-2	-1	0	+1	+2		
- Alignment of the project portfolio with the organisation's objectives	-2	-1	0	+1	+2		
- Alignment of the project portfolio with organisation's IT architecture	-2	-1	0	+1	+2		
- Rigorous assessment of economic and technological risks in the portfolio	-2	-1	0	+1	+2		
- Processes to diversify risks across the portfolio	-2	-1	0	+1	+2		
- Better management of project interdependencies	-2	-1	0	+1	+2		
- Use of portfolio management software	-2	-1	0	+1	+2		

Section 5: Challenges of implementing project portfolio management

To what extent are the following major challenges in implementing a project portfolio approach?

	Not at all				To a great extent	
- Lack of knowledge of portfolio management techniques	1	2	3	4	5	N/A
- Staff turnover	1	2	3	4	5	N/A
- Frequent project scope changes	1	2	3	4	5	N/A
- Lack of resources (people/financial) to analyse project data	1	2	3	4	5	N/A
- Lack of a clear company strategy	1	2	3	4	5	N/A
- Lack of relevant training	1	2	3	4	5	N/A
- Lack of appropriate way to measure project benefits	1	2	3	4	5	N/A
- Lack of commitment of business leaders	1	2	3	4	5	N/A
- Lack of knowledge to evaluate risks	1	2	3	4	5	N/A
- Lack of financial skills of project/other staff	1	2	3	4	5	N/A
- Lack of cross-functional communication	1	2	3	4	5	N/A

Appendix B

Section 2 average scores by adoption stage

Questions	Average score[a]			
	Stage 1	Stage II	Stage III	Total
Have an inventory of current and proposed significant projects?	2.75	3.19	3.90	3.29
Have a central point responsible for collecting, analysing and distributing project information in a common format?	2.50	3.14	3.80	3.19
ROI	2.13	3.00	3.60	2.97
NPV	1.88	2.90	3.25	2.69
IRR	1.71	2.88	3.13	2.61
Economic value added (EVA)	1.17	2.00	3.25	2.00

(*continued on next page*)

Appendix B (*continued*)

Questions	Average score[a]			
	Stage 1	Stage II	Stage III	Total
Real options	1.25	2.20	3.40	2.36
Payback period	2.63	2.92	3.67	3.07
Complexity of project	2.25	3.13	3.90	3.15
Technology risk	2.38	3.25	3.90	3.24
Expertise and experience of the team	1.63	2.87	3.90	2.88
Market and environmental risks	2.13	2.20	3.60	2.61
Financing/cash-flow	2.88	2.80	3.80	3.12
Organisational change	1.88	2.73	3.30	2.70
Management commitment	1.57	2.71	3.60	2.74
Cross-project dependencies	1.43	2.69	3.80	2.76
Overlaps and duplication	1.63	2.44	3.67	2.58
Implementation bottlenecks, e.g., too much change in one area	1.25	2.88	3.30	2.62
Competition for scarce resources	1.13	2.94	3.40	2.65
Organisational capacity to absorb change	1.25	2.13	3.30	2.27
Staff capabilities to implement projects	1.13	2.38	3.50	2.41
Budgets/financial capacity	2.38	3.31	3.90	3.26
Financial analysis of project portfolio	1.50	2.64	3.70	2.69
Overall risk analysis of project portfolio	1.13	1.87	3.40	2.15
Risk vs. reward analysis of project portfolio	1.25	2.00	3.10	2.16
Project diversification	1.00	1.63	3.29	1.95
Categorization of projects to ensure a balanced mix, e.g., short-term vs. long term, supply side vs. market side, etc.	1.20	1.88	3.11	2.23
Alignment of the project portfolio with organisation's strategy	1.63	3.13	3.80	2.97
Alignment of the project portfolio with organisation's IT architecture	1.38	2.81	3.70	2.74
Customer impact of the project portfolio results	1.38	2.44	3.50	2.50
Have top management involved in the project selection process	2.38	3.33	3.60	3.18
Have business leaders accountable for project results	1.50	2.44	3.50	2.53
Have systematic reviews of projects at specific stages, e.g., stage gates	1.63	2.67	3.70	2.73
Centrally track the benefits of projects?	1.00	1.62	3.40	2.03
Compare the outcome of projects with their original targets?	1.25	2.06	3.90	2.41
Have regular project portfolio reporting?	1.63	2.88	3.60	2.79
Analyse the impact of individual new projects to the overall portfolio?	1.13	2.13	3.20	2.21
Annually (or more frequently) prioritise the overall project portfolio?	1.25	3.13	3.80	2.88
Regularly review and revise the project portfolio (eg several times a year)?	1.25	2.64	3.40	2.53
Use specialized software to manage your portfolio of projects?	1.00	1.67	2.38	1.73

[a] Scale: 1, do not use; 2, use occasionally;, frequently use; 4, always use.

References

[1] Linenberg Y, Stadlker Z, Arbuthnot S. Optimising organisational performance by managing project benefits. PMI Global Congress 2003, Europe.
[2] Lycett M, Rassau A, Danson J. Programme management: a critical review. Int J Proj Manag 2004;22(4):289–99.
[3] Markowitz H. Portfolio selection. J Financ 1952;7:77–91.
[4] McFarlan FW. Portfolio approach to information systems. Harvard Bus Rev 1981(September–October):142–51.
[5] Wheelwright SC, Clark KB. Creating project plans to focus product development. Harvard Bus Rev 1992;70(2): 67–83.
[6] GAO. Improving mission performance through strategic information management: learning from leading organisations; May 1994.

[7] Thorp J. The information paradox – realizing the business benefits of IT. Toronto: McGraw-Hill; 1999.
[8] Jeffery M, Leliveld I. Best practices in IT portfolio management. Sloan Manag Rev 2003;45.
[9] Dickinson MW, Thornton AC, Graves S. Technology portfolio management: optimizing interdependent project over multiple time periods. IEEE Trans Eng Manag 2001;48(4):518–27.
[10] CIO Council. A summary of first practices and lessons learned in ITPM; March 2002.
[11] Matheson D, Matheson J. The smart organization. Boston: Harvard Business School Press; 1998.
[12] Kendall G, Rollins S. Advanced project portfolio management and the PMO. Florida: J. Ross Publishing; 2003.
[13] Benaroch M. Managing information technology investment risk: a real options perspective. J Manag Inform Sys 2002;19(2):43–84.
[14] McGrath GR, Macmillan IC. Assessing technology projects using real options reasoning. Res Technol Manag 2000(July–August): 35–49.
[15] Goldman C. Align drive – expert advice. CIO Mag 1999(January):5.
[16] Lawrie G, Metcalfe D, Hollaway E. Grading Service Automation Apps for Corporate IT. Forrester 2003(Sep).
[17] Datz T. Portfolio management – how to do it right. CIO Mag 2003:2.
[18] Payne H. Management of multiple simultaneous projects: a state-of-the-art review. Int J Proj Manag 1995;13(3): 163–8.
[19] Berinato S. Do the math. CIO Mag 2001:3.
[20] Dixit AK, Pindyck RS. Investment under uncertainty. Princeton: Princeton University Press; 1994.
[21] Trigeorgis L. Real options: managerial flexibility and strategy in resource allocation. Massachusetts: MIT Press; 1996.
[22] Ibbs W, Reginato J. Quantifying the value of project management. PMI, Newton Square, PaPA 2002.
[23] Turner JR, Cochrane RA. Goals-and-methods matrix: coping with projects with ill defined goals and/or methods of achieving them. Int J Proj Manag 1993;11(2):102–293.
[24] SPSS Base 12.0 Users's Guide. Prentice Hall; 2003 [Chapter 33].