How does project management relate to productivity?

A systematic review of published evidence

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Table of contents

Table of figures

Executive summary

There is recently renewed policy, practice and research interest in the topic of productivity. While the contribution of project management to productivity has often been assumed, evidence about this relationship is rarely examined. In this systematic review of 146 published studies, we examined the research questions, methods and conclusions of previous research into how project, programme and portfolio management contribute to productivity and productivity improvements.

The review highlighted a number of key findings. These include:

- Productivity is often measured in terms of outputs per time or resource spent when studying project management. The focus shifts towards more intangible outcomes or impacts, and strategic value when considering the contribution of programme and portfolio management.

- There is no unifying framework to assess project management practices and productivity. Current evidence tends to be based on self-perception or self-reporting data, often collected through surveys. Although a unifying framework is likely to be neither possible nor desirable, it is important that those who evaluate the productivity impacts of project management practices clarify the terms of reference used.

- There is a strong emphasis on particular sectors, such as construction and information systems. Far less attention is paid to examining the contribution of project management practices to productivity in the service sector. There is also an absence of studies that examine the value of project management on managing organisational change across the private, public and third sectors.

A number of recommendations have also emerged from this review, including:

01
There is a need for much broader definition of "project management" that goes beyond the tactical to the strategic[1].

02
There is a need to develop new measures of "productivity" that take into account a more holistic understanding of value and outcomes. This renewed focus on outcomes should align with growing emphasis on benefits realisation in the profession.

03
There is a need for closer inspection of how incentivisation for productivity works in the management of projects, programmes and portfolios.

04
There is a need for systematic case study research that zooms into how particular practices over the whole project life cycle can impact on productivity outcomes.

05
There is a need for studies in knowledge-based work in sectors outside traditional production (eg the service sector, public sector and third sector).

06
There is a need to study how project management can add value to the management of intra- and inter-organisational change.

07
There is a need to undertake studies into how non-project managers perceive the value of project management practices.

1 Emeritus Professor Morris has, since the 1990s, called for a more strategic view of projects as he reframed project management to the management of projects (see also Morris, 2013).

> “In this systematic review of 146 published studies, we examined the research questions, methods and conclusions of previous research into how project, programme and portfolio management contribute to productivity and productivity improvements”

Introduction

Since the global financial crisis (GFC) a decade ago, there has been renewed interest in driving productivity improvements. In the UK, for instance, policy discourse has shifted away from "high performance working" (Stone et al, 2012) to a focus on productivity. This is exemplified in the recent *Industrial Strategy* (BEIS, 2017) in which the term "productivity" featured 197 times in a 256-page report. In the foreword of this Industrial Strategy, Greg Clark, the secretary of state for business, energy and industrial strategy (BEIS), sets out the "productivity conundrum":

"For all the excellence of our world-beating companies, the high calibre of our workforce and the prosperity of many areas, we have businesses, people and places whose level of productivity is well below what can be achieved." (BEIS, 2017: 6)

This conundrum is, however, not merely confined to the UK. At a macroeconomic level, the OECD (2015) report *The Future of Productivity* presented evidence to indicate that the nature of productivity decline across the OECD countries since the GFC is different to that of previous recessions. The decline is much more persistent this time round. As the OECD (2015: 23) noted, in 2013 "average [multi-factor productivity] in the OECD remained almost 2 per cent below the pre-crisis level of 2007", and this is despite relatively resilient employment levels (see also Grice, 2012). Thus, the post-GFC policy drive to focus on productivity improvements is about finding ways to boost the economy and standards of living by doing more with less.

At the micro level, the management of projects continues to play a vital role. The World Bank and various estimates have indicated that capital projects constitute between a quarter and 30 per cent of global GDP, and this proportion increases – in some cases to nearly half – in developing countries (Bredillet et al, 2013; Scranton, 2014; World Bank, 2016). Capital investment projects are also named in the UK *Industrial Strategy* as one of the key pillars for building the infrastructure needed to drive economic growth. Recent forecasts have also indicated significant growth in project-based working. Schoper et al (2018), for instance, projected a rise in the share of project work on total working hours across Europe. They also highlighted that, apart from capital projects that often involve an external client, there is major growth in projects undertaken internally within organisations (eg in organisational change projects). Flyvbjerg and Turner (2018) also noted how mega-project spending remained resilient during the recession as they cited estimates that suggest a trebling of such spending over the next decade.

Despite the growing prevalence of project-based work, and the significant contribution that projects make to economic development, the link between project management and productivity is surprisingly under-researched[2]. In asking whether project management affects business productivity, for example, Pollack and Adler (2014) argued that the relationship is often assumed; yet, "this assumption typically remains unexamined" (Table 1, p. 17).

The purpose of this systematic review is, therefore, to examine published evidence to establish quantitatively and qualitatively how project management contributes to productivity. Its specific objectives are:

- to determine the value of project management methodologies and skills in driving productivity improvements in projects, at the workplace and in industry/economy;
- to compare productivity studies of a range of project-based industries in order to identify points of convergence and points of divergence in relation to project management methodologies and expertise;
- to highlight key project management practices across target-setting, incentivisation and monitoring that enable productivity improvements, and;
- to produce qualitative vignettes that clearly show promising project management practices that lead to productivity improvements.

2 The Scandinavians have coined the term "projectification" to recognise how projects permeate across everyday life (see eg Jensen, Thuesen and Geraldi, 2016 for a recent thought-piece on this). In the UK, APM is also working with PwC to examine the value projects and project management bring to the economy.

Systematic review method: search and analytical strategy

A systematic review was adopted to evaluate published studies on project management and productivity. Unlike conventional narrative reviews, systematic reviews – which originated from the medical and health sciences – are a thorough and transparent way of mapping and assessing the evidence in a particular topic area (Tranfield et al, 2003). Other review methods such as bibliometric analysis (eg Pollack and Adler, 2015) and analysis of meta-narratives in the literature (eg Padalkar and Gopinath, 2016) were also considered. These methods tend to rely on quantitative methods to identify keyword frequencies and the changing trends of keyword associations. However, as the purpose here was to examine more thoroughly the relationship between project management and productivity, it was important to blend both quantitative and qualitative analyses in this review study. Doing so will help answer respectively the "what" question, as well as the "how" and "why" questions relating to the link between project management and productivity.

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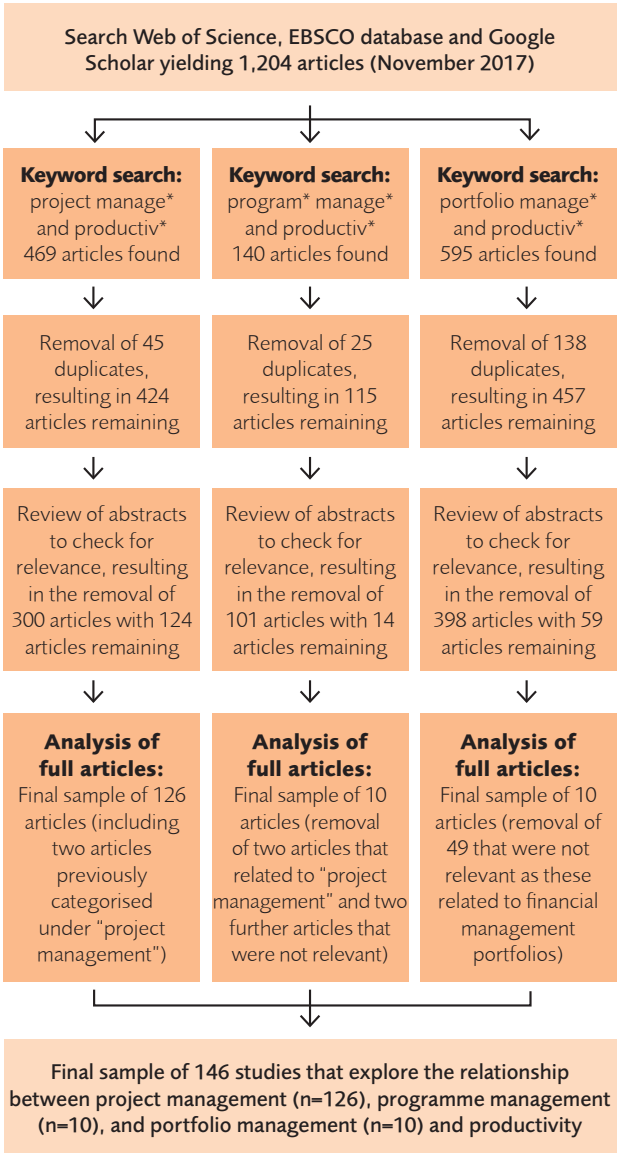
Search strategy:

SCOPE AND PROCESS

Figure 1, right, illustrates the search process used to identify all the relevant studies on project management and productivity. We searched for published articles with no time boundary indexed in the Web of Science and EBSCO databases, as well as on Google Scholar. The search was undertaken in November 2017, based on the following keywords in the subject topic, title and abstract fields: "project manag*" OR "program* manag*" OR "portfolio manag*" AND "productiv*"[3]. The choice of these keywords enabled the identification of a broad range of studies that considered the associations between project, programme (also covering studies reported using the American spelling of "program") and portfolio management/manager and productivity. The initial search yielded 1,204 articles, including 469 articles relating to project management, 140 articles relating to programme management, and 595 articles relating to portfolio management. A total of 208 duplicate articles were removed.

We then checked each of the 996 remaining articles for relevance by reviewing the title and abstract of each article. As the purpose of this review is to evaluate the evidence of the link between project management and productivity, a deliberate choice was made to include only articles that report on empirical results. Some discussion and conceptual papers were also considered to be relevant if there was an indication in the abstract that the authors had included some empirical material (eg an illustrative case study). From the empirical studies remaining, we excluded studies that did not have productivity as their main focus of research. Where this is ambiguous from the abstract, the article was reviewed to ensure that productivity was the main research focus before a decision to include or exclude was made. We also excluded articles that were deemed to be irrelevant to the definitional scope of project, programme and portfolio management (see Box 1). For example, a number of articles on agricultural programmes were excluded because these related to the coordinated management of crops, rather than the management of projects and change. Similarly, although the initial search yielded quite a substantial number of articles on portfolio management, many were rejected because these related to financial portfolios and not to the coordination of projects and programmes to meet the strategic objectives of an organisation. Following this relevance check, 197 articles made it into the sample of studies analysed for this systematic review, including 124 studies relating to project management, 14 relating to programme management, and 59 relating to portfolio management.

Figure 1. Flowchart showing the search and analytical process



BOX 1: Definitions of project, programme and portfolio management based on the *APM Body of Knowledge, 6th edition*

"Project management is the application of processes, methods, knowledge, skills and experience to achieve the project objectives. [...] A project is a unique, transient endeavour, undertaken to achieve planned objectives, which could be defined in terms of outputs, outcomes or benefits." (APM, 2012: 12)

"Programme management is the coordinated management of projects and change management activities to achieve beneficial change." (APM, 2012: 14)

"Portfolio management is the selection, prioritisation and control of an organisation's projects and programmes in line with its strategic objectives and capacity to deliver." (APM, 2012: 16).

3 The appropriateness of these search terms was also discussed at two steering group meetings with key stakeholders at the Association for Project Management (APM) Research Advisory Group.

Analysis of articles

Each of the 197 articles included in the sample of studies was then analysed. To facilitate close reading of each article, a coding structure was used to classify and analyse each article. See Box 2, right, for a summary of the coding structure. Apart from standard bibliometric details (ie year of publication, details of authors, journal and article title), studies were also categorised in terms of industry sector and activity context. Furthermore, articles were also categorised by the level of analysis, whether this related to micro (ie firm-level or organisational-level activities), meso (ie industry-level activities), or macro (ie macroeconomic concerns). As project, programme and portfolio management are associated mainly with micro-level practices, articles that related to macroeconomic concerns were excluded from this review.

Finding a precise link between productivity and particular practices of managing projects, programmes and portfolios is likely to be difficult. As Stone et al (2012) argued, rather than to find a direct causal link between specific management practices and productivity, it is more sensible to take a contingent approach and look for bundles of practices that are more or less likely to lead to more productive outcomes. Indeed, in answering whether project management leads to higher productivity among small and medium-sized enterprises (SMEs) in Australia, Pollack and Adler's (2014) longitudinal study yielded inconclusive findings on specific practices. Bender et al (2016) also cautioned that while some management practices can have a direct impact on productivity, the evidence points to a much more complex picture where bundles of management practices are mediated through organisational design and the ways employee efforts and role in decision-making are recognised. Drawing on the seminal work of Bloom et al (2012) on establishing the link between management practices and productivity[4], we adopted their bundles of management practices to categorise the sample of studies included in this review. These bundles include:

- target setting: setting of targets, tracking outcomes, and taking appropriate action if the targets and outcomes are inconsistent;
- performance monitoring: monitoring performance information for continuous improvement;
- incentivisation: promoting and rewarding employees on performance; and
- operations: deployment of advanced management practices (eg lean production).

Taking APM's (2012) definition of project management, we also classified articles according to three key focal areas: project management as a management tool or technique, project management education, and project-based sectors (eg construction, software development). Furthermore, we also categorised the articles into studies that focus on input measures, output measures and/or process issues (ie project life cycle).

BOX 2: Coding structure for the systematic review

Year:	Year of publication
Author(s):	Surnames and abbreviated forenames of authors
Journal:	Journal title
Title:	Title of article
Volume:	Volume number (where available)
Issue:	Issue number (where available)
Page:	Page range (where available)
Scope:	Project, programme or portfolio
Empirical approach:	Research method(s) used
Type:	Empirical, conceptual or discussion papers
Sector:	Industry sector
Level:	Micro, meso or macro
Activity:	Context and unit or level of analysis
Bundle of practices:	Target setting, monitoring, incentivisation and/or operations
Focus:	Technique, education and/or sectoral investigation
Definition:	Definition of productivity in the article (explicit or implied)
Key element:	Input, output and/or process
Quality:	Numerical rating of the strength of evidence
RQ:	Research question from the introduction
Method:	Short summary of research method
Finding:	Key finding from the article
Agreement:	"1" – fully agree; "0.5" – partially agree; "0" – disagreement

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In addition to the classifications above, the analysis also entailed more qualitative assessment of each study. The review of each paper also captured the research question asked by the respective authors of each study, as well as their definition of productivity. It is worth noting that the research question was not always clearly articulated in the articles, so inferences were made in such cases based on what the authors have done (ie methods) and what they have found (ie results). It was also not always clear how productivity was defined; where such a definition was not explicitly defined, inferences were made by examining what was measured in the methods and/or what was found in the results.

The methods and findings of each paper were also summarised in a Microsoft Excel spreadsheet. The quality of evidence was also evaluated. Adapting the hierarchy of evidence from Tranfield et al (2003), we classified each study according to:

01
Very weak evidence based on personal experiences and/or opinions;

02
Weak evidence based on expert opinions (what constitutes an "expert" is often not fully explained);

03
Neither strong nor weak evidence, often based on a mixture of personal opinions supported by data collected. It is not always clear how the data was collected in these examples;

04
Strong evidence based on systematic case study research, and;

05
Very strong evidence based on randomised experiments.

During the analysis, a number of articles were found not to be relevant to this review. Two studies were incorrectly classified as "programme management" when these were really about "project management". Two further studies classified under "programme management" were later excluded, as these studies did not seek to find a relationship between programme management and productivity. Forty-nine articles classified as "portfolio management" were also excluded as these related to financial and asset portfolios rather than the management of portfolios of projects and programmes. The final sample analysed in this review included 146 studies.

Each article was reviewed by two independent reviewers, and the classifications and records for each paper were cross-checked. A rating of "1" was used to signify full agreement between the two reviewers, and "0" was used to indicate clear disagreement. Where there is partial agreement, this was recorded as "0.5". The sum of the ratings on agreement was then divided by 146 studies to give an inter-rater reliability of 0.798. This means that the two independent reviewers agreed on 79.8 per cent of the analytical coding of the 146 articles reviewed. Where there was disagreement, the papers were reread and the final coding was agreed by the two independent reviewers.

4 Bloom et al (2012) is a large-scale longitudinal pan-sector study based on double-blind survey data on about 10,000 organisations across 20 countries. Management practices were measured on a scale of 1–5 based on the maturity of management practices, with "1" being worst-performing (ie ad hoc) and "5" being best-performing (ie systematic and deliberate deployment of practices to optimise performance). Productivity was measured through a number of measures including turnover per employee and profitability.

Results

Distribution of articles by journal and industry sector focus

Figure 2 shows the distribution of articles linking productivity with project, programme and portfolio management. As expected, the majority of studies focused on establishing links between project management and productivity.

The earliest study was published in 1978 on the relationship between experience and productivity of software projects. This was almost a decade after project management became formalised as a new profession in the US. This time lag is not surprising given how the emphasis in the formative years in the 1970s was more about laying the foundational concepts and principles of what was then a nascent professional discipline (see eg Garel, 2013).

The late 1980s and 1990s saw a growth in the number of studies found. This growth coincided with the drive globally to improve productivity as a consequence of the global economic recession in the 1980s. Given the publication time lag, we also observe a growth in the number of studies from 2011 following the GFC of 2008–2009. There has also been a recent increase in the number of studies that consider the relationship between project management and productivity following the GFC in 2008–2009. By 2016, the number of studies that examined project management and productivity was nearly four times the average number of studies reported in the 1990s. This corresponded, at least in the UK, with efforts to drive improvements in the delivery of major projects (see National Audit Office, 2016).

Figures 3–5, below and overleaf, depict the distribution of journals where studies of the link between productivity and project, programme and portfolio management are published. Figure 6 also illustrates the types of industry sectors that the variety of journals represent, and Figure 7 shows the distribution of activity areas studied across the 146 articles reviewed. The construction and IT (mainly software development) industrial sectors dominate studies on project management and productivity. This is expected, since much early research in project management concentrated on these industry sectors (see Pollack and Adler, 2015, for a recent review). Despite the much lower number of studies included in this review, it appears that the focal areas for programme and portfolio management were distinct from that of project management. Apart from information systems, there were also studies that examine programme management and productivity in the public sector. Studies on programme management and productivity were concerned about the management of change. This is unsurprising given how the early foundation of programme management was strongly associated with change (see eg Partington, 1996; Pellegrinelli, 1997; Morris et al, 2006). On portfolio management, the emphasis seems to be on strategic alignment and the prioritisation of programmes and projects. There is also an emphasis on innovation and new product development projects in studies that examine the relationship between portfolio management and productivity.

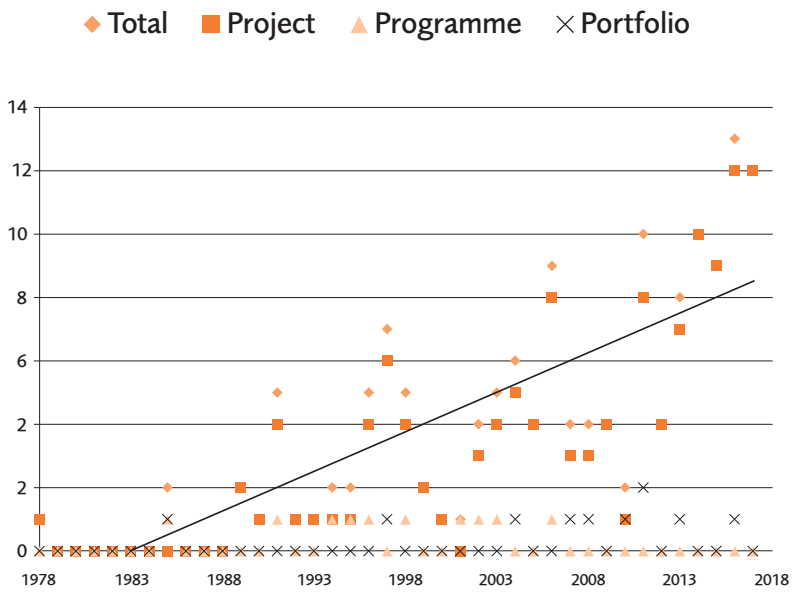


Figure 2. Distribution of articles from 1978 to 2018

Project management and productivity

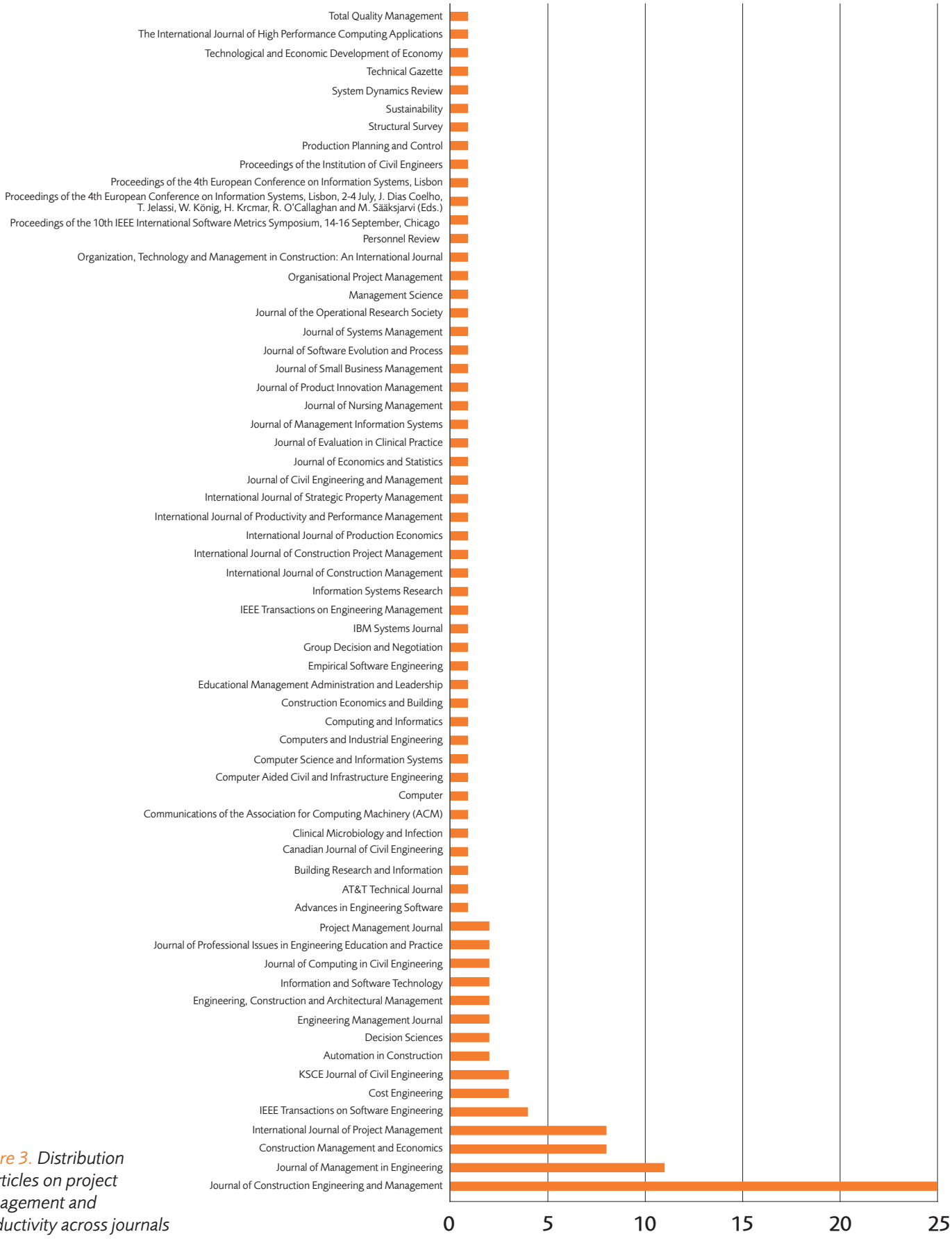
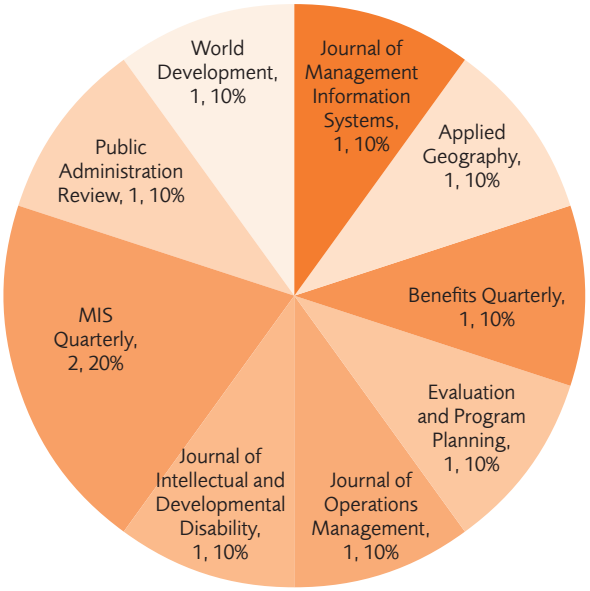


Figure 3. Distribution of articles on project management and productivity across journals

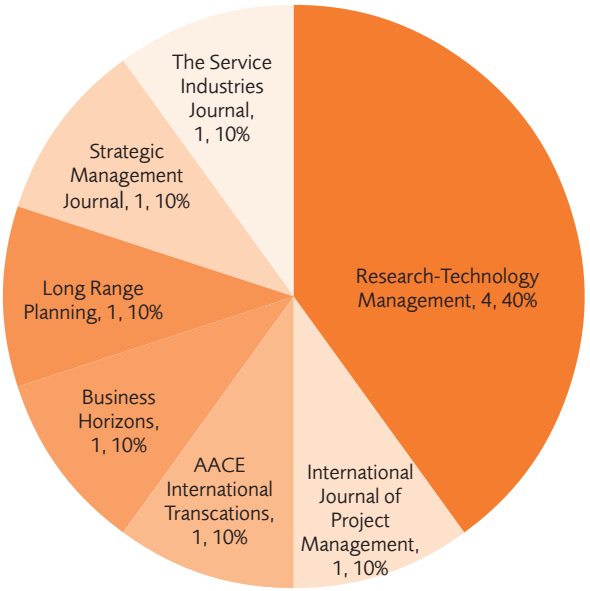


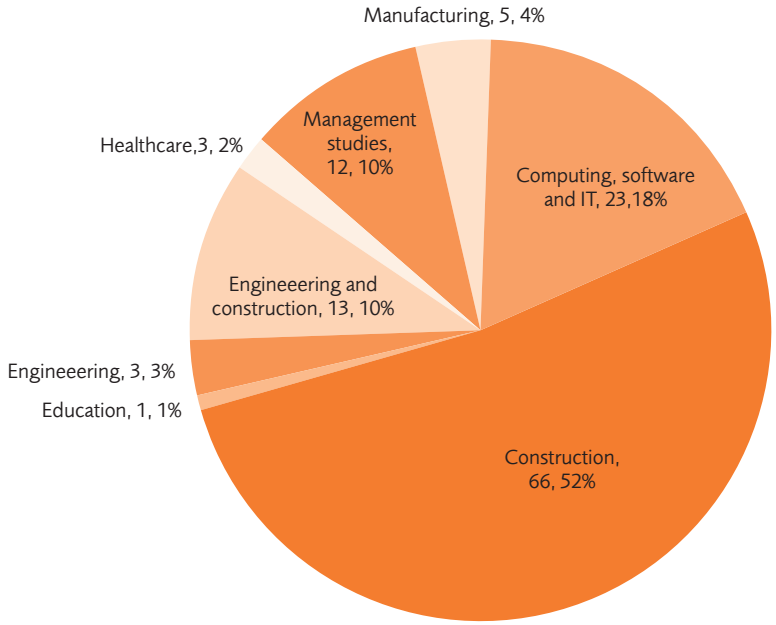
Project management and productivity

Figure 4. Distribution of articles on programme management and productivity across journals

Project management and productivity

Figure 5. Distribution of articles on portfolio management and productivity across journals





Sector focus of journal

Figure 6. Distribution of sector focus of source journals

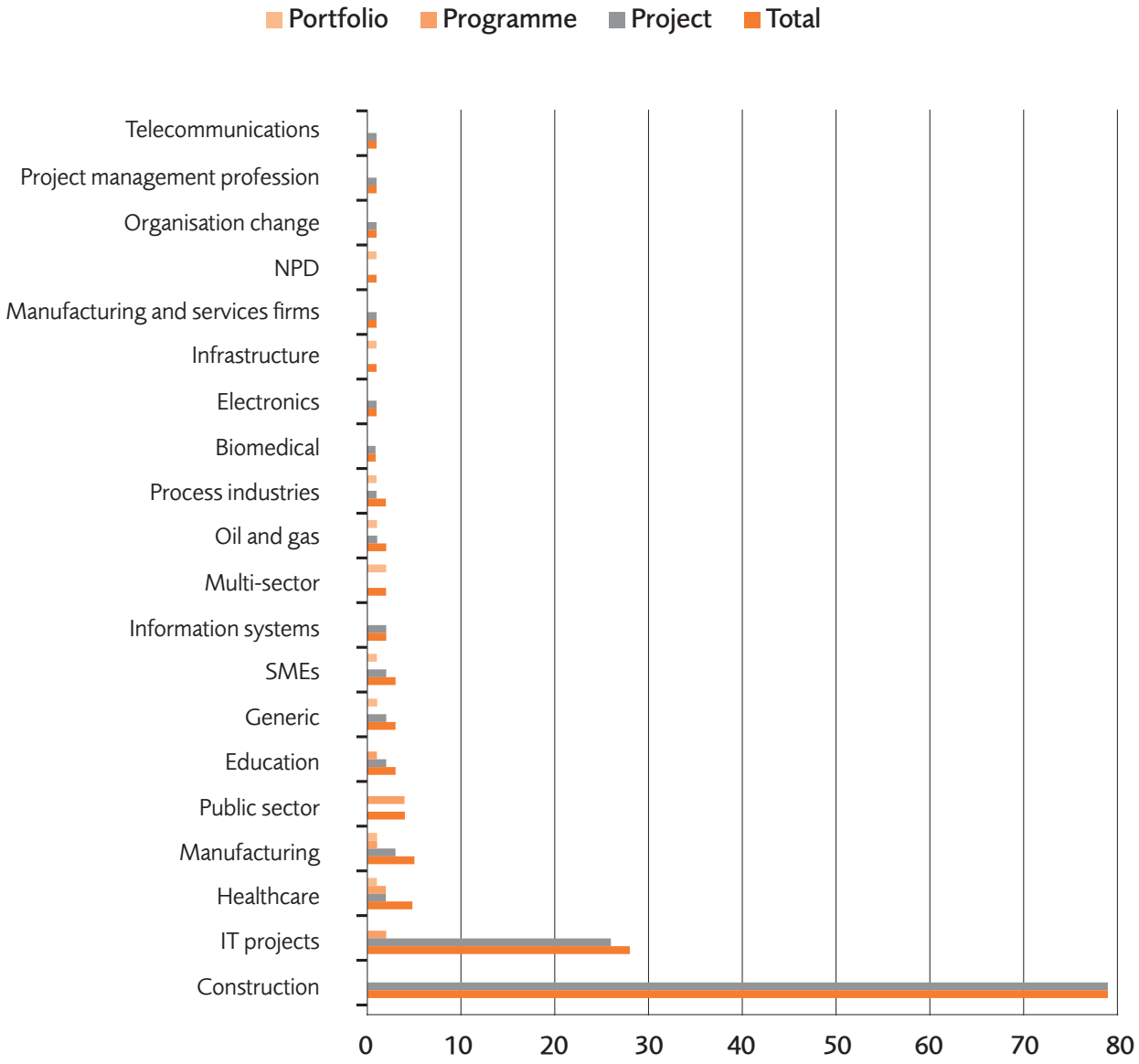


Figure 7. Distribution of activity areas of studies reviewed

Types of research questions asked

Table 1 below summarises the main themes of investigation across the 146 studies reviewed. Two key areas emerged as prominent themes of long-standing interest, namely the factors that affect productivity, and the ways of measuring productivity. Therefore, researchers have mainly been keen on asking what leads to better productivity (Theme C) with some attempting to quantify individual factors (Theme A) or their effects (Theme E), as well as how productivity can be measured (Theme B). There are a few studies that focus on identifying and explaining sectoral variations in productivity (Theme D). There is also a growing body of research that attempts to find ways of improving productivity. As will be discussed later on, a great deal of emphasis is placed on identifying the inputs that could lead to high(er) productivity levels. Despite claims by researchers in seeking holistic understanding of these inputs, there is currently no unified framework to account for all the inputs. Neither is having such a unified, one-size-fits-all framework possible nor desirable given the importance of context (see eg Stone et al, 2012; Bloom et al, 2012; Bender et al, 2016).

Table 1. Key themes emerging from the research questions

Focal Area	Theme	Research Question(s)	Exemplary References
Project	A. Measuring and quantifying factors of productivity (How many or how much input)	How can construction productivity influence factors be quantified to improve productivity estimates? How can we quantify engineering project scope? What are the impacts of cognitive and socio-demographic factors on improving the quality of team meetings in software development projects? How can we automatically assess construction labour productivity?	Herbsman and Ellis (1990); Song and AbouRizk (2005); Akman et al (2011); Cheng and Teizer (2013)
Project and programme	B. Productivity measurement (How many or how much output)	How accurate are our estimates of human effort, and how accurate are the estimators? How do we measure outputs in software development projects? How do software project managers cope with poor initial estimates? How are metrics selected and implemented? How can efficiency of software development and maintenance projects be measured? What are the performance dimensions of new product development projects? How can artificial neural networks estimate software development performance? How can we model the baseline productivity of construction projects? How can we measure in a software reuse context? How does workflow variability and labour productivity relate to performance? How can a building project model be developed for automated labour monitoring? What are the productivity trends? How can we analyse design productivity? Can average earned-value performance over the first part of the project be used to calculate productivity? Can Six-Sigma offer a leading indicator for measuring project performance? How can productivity of concrete pavement operations be assessed? How can we model construction labour productivity using a system dynamics approach? What is the current level of construction productivity in the Norwegian electrical construction sector? How can an integrated fuzzy system dynamics (SD) approach be used for modelling labour productivity? How is performance measured in public sector programmes? How can we evaluate whether programmes have attained set policy goals? How do we measure service productivity?	Vicinanza (1991); Banker and Kauffman (1991); Dale and van der Zee (1992); Abdel-Hamid et al (1993); Weller (1994); Cook and Vansant (1995)*; Akuoko-Asibey (1996)*; Mahmood et al (1996); Loch et al (1996); Witting and Finnie (1997); Thomas and Završki (1997); Rothenberger and Dooley (1999); Thomas et al (2002); Green (2003)*; Stensrud and Myrtveit (2003); Sacks et al (2003); Tischer and Kuprenas (2003); Cox et al (2003); Premraj et al (2004); Kennedy et al (2004); Michalski (2005); Ok and Sinha (2006); Ellis and Lee (2006); Ezeldin and Sharara (2006); Chang and Ibbs (2006); Cioffi (2006); Radosavljevic and Horner (2007); Ibbs et al (2007); Han et al (2008); Ibbs and Liu (2011); Panas and Pantouvakis (2011); Nasirzadeh and Nojedehi (2013); Zhao and Dungan (2014); Unluturk and Kurtel (2015); Heravi and Eslamdoost (2015); Nguyen and Nguyen (2015); Hajikazemi et al (2016); Tsehayae and Fayek (2016); Choudhry (2017); Kisi et al (2017); Nojedehi and Nasirzadeh (2017)

NB: * refers to a reference to "programme management", and ** to "portfolio management".

Table 1. Continued

Focal Area	Theme	Research Question(s)	Exemplary References
Project and portfolio	C. Factors affecting productivity (What factors)	How do task complexity and experience of programmers affect programme development time? How can computer technology increase productivity? What are the factors affecting software development productivity, and how do these change over the project life cycle? What are the factors affecting construction time performance? What are the reasons for productivity problems in high-rise construction in Indonesia? What business practices and business models affect productivity of software projects? What specific elements of partnering affect project success? What are the social and organisational impacts of project management tools? What are the factors contributing to project delays and how do perceptions differ across client, consultant and contractor groups? How do management policies affect plant-level productivity? What is the role of gender in project performance? Does social media increase labour productivity? What is the relationship between size and productivity of a software development team? What is the relationship between trust and construction productivity? What skills improve profitability? What is the relationship between buildability and formwork labour productivity? What role do innovation domains play in focusing innovation projects?	Chrysler (1978); Krieg and Goslar (1989); Abdel-Hamid and Madnick (1989); Finlay and Mitchell (1994); Walker (1995); Kaming et al (1996; 1998); Potok (1997); Larson (1997); Metcalfe (1997); Kumaraswamy and Chan (1998); Galbraith and Nkwenti-Zamcho (2005); Chan and Kaka (2007); Cigolini and Grando (2009); Henderson and Stackman (2010); Wambeke and Hsiang (2011); Liao and O'Brien (2011); Liu et al (2011); Ramírez et al (2011)**; Ghoddousi and Hosseini (2012); Gudiene et al (2013); Sarbu (2013); Rojas (2013); Ribeiro et al (2013); Tsehayae and Fayek (2014); Gatti et al (2014); Chen et al (2014); Lee et al (2015); Araújo and Pedron (2015); Ling and Tan (2015); Scholtes et al (2016); Chalker and Loosemore (2016); Pollack and Adler (2016); Jarkas (2016); Wang et al (2017); Hwang et al (2017); Azzeh and Nassif (2017); Nguyen and Watanabe (2017)
	D. Sectoral comparisons (What is different, how and why)	Are there differences in the performance of new product development projects across industries? Why are there differences in productivity of new product development projects?	Loch et al (1996); Cooper and Edgett (2007)**

Table 1. Continued

Focal Area	Theme	Research Question(s)	Exemplary References
Project, programme and portfolio	E. Factors affecting productivity (What effects)	What are the effects of change orders on labour productivity? What is the impact of rain on productivity losses? What are the impacts and causes of delays in the Hong Kong civil engineering sector? What are the effects of introducing lean methodology to patient care? What are the impacts of project management assignment? What are the impacts of early information on redesign? What are the impacts of adding new personnel to deal with delays in software projects? What are the effects of production control strategies on productivity and work-in-progress? What are the impacts of rework timeframe and frequency/length? What are the impacts of implementing the Toyota Way on large construction firms in China? What are the effects of stress and burnout? What is the impact of scheduled overtime on labour productivity? What are the impacts of BIM on productivity in the Singaporean precast concrete industry? What are the impacts of reusability in software projects? What are the impacts of IT investment on productivity? What are the impacts of moving towards outcomes-based performance management systems in the public sector? What are the effects of mergers and acquisitions? How can we assess the financial impacts of real-world capital investment decisions on project efficiency?	Banker and Kauffman (1991); Hanna et al (1999; 2002); Guo (2000; 2002); Thatcher and Oliver (2001)*; Heinrich (2002)*; Hanna and Gunduz (2004); Lo et al (2006); Ibbs et al (2007); Wilson (2009); Siegel and Simons (2010)**; Patanakul (2011); Chua and Hossain (2011); Farshchi et al (2012); Hajifathalian and Wambeke (2012); Arashpour and Wakefield (2014); Gao and Low (2014); Pollack and Adler (2014); Arashpour and Arashpour (2015); Larsson et al (2015); Enshassi et al (2016); Woo (2016); Nath et al (2016); Paquin et al (2016)**; Liao et al (2017); Karimi et al (2017)

NB: * refers to a reference to "programme management", and ** to "portfolio management".

Table 1. Continued

Focal Area	Theme	Research Question(s)	Exemplary References
Project, programme and portfolio	F. Productivity improvement (How)	How can computer technology increase productivity? How do the factors affecting software development productivity change over the project life cycle? How effective is project management education and training on on-the-job performance? How can managing projects as a process improve performance? How do we select software tools to support business process redesign? How do performance dimensions drive success of new product development projects? How can project management be used to introduce new manufacturing philosophies? How do managers use object-oriented metrics to manage the performance of software development projects? How can the monitoring of productivity help improve construction productivity? How can TQM be applied more actively in the construction industry? How do you achieve faster development times while intentionally delaying front-end optioneering? How does specialisation and variety combine to drive employee productivity? What are subcontractors' perspectives of improving construction productivity? How can we develop a proactive productivity management system? How can we develop a multi-objective model for optimising productivity performance of software developers? What management programmes can improve construction labour productivity on large industrial projects? How can we develop a framework to promote innovative learning in complex operational tasks in oil and gas projects? How can employers rationalise provision of health benefits to their employees? How can we manage a sales portfolio? How can we prioritise resources in new product development projects? How are traditional project management tools used to manage portfolios? How can service productivity improvement targets be chosen to identify failure-prone innovation processes? How can portfolio management be more effective?	Laforge et al (1985)**; Krieg and Goslar (1989); Abdel-Hamid and Madnick (1989); Loo (1991); Sieli (1991); Bach (1996); Loch et al (1996); Cooper et al (1997)**; Abdul-Nour et al (1998); Chidamber et al (1998); Ford and Ford (1998)*; Cooper and Edgett (2004)**; Jenkins and Orth (2004); Low and Teo (2004); Ford and Sobek (2005); Cottrell (2006); Coulter (2006)*; Minchin et al (2006); Ardren (2008)**; Narayana (2009); Geum et al (2011)**; Pradhan and Akinci (2012); Menke (2013)**; Polesie (2013); Loosemore (2014); Xu and Yeh (2014); Gao et al (2014); Nicholls and Lewis (2015); Stylianou and Andreou (2016); Shan et al (2016); Hou et al (2017); El-Gohary et al (2017)

Strength of evidence & research methods used

The distribution of research methods used along with the strength of evidence produced are illustrated in Figures 8 and 9 respectively. The three most commonly used methods are modelling, self-reporting or self-perception questionnaire survey, and case study research. Modelling was used mainly to answer the two key research questions of concern; that is, to measure the effects of particular factors on productivity or to estimate productivity either in terms of developing a baseline measure or by estimating productivity losses.

Forty-seven studies were based on survey results. However, of these 47 studies, five studies did not provide details on the respondents, so it was difficult to assess the validity of the sampling strategy. Of the remaining 42 studies, 15 (or 35.7 per cent) were based on fewer than 50 responses while 24 (or 57.1 per cent) were based on fewer than 100 responses. Often, surveys were used to find associations between individual factors and productivity. There were a number of large-scale surveys worth noting. For instance, Henderson (2010) reported on the results of 563 internet survey responses drawn from nearly 5,000 subscribers on a US-based chief project officer membership website to investigate the role of gender and project team dynamics. Sarbu (2013), through a telephone survey of 907 German manufacturing firms, found that the use of social media can result in lower labour productivity if this is used sub-optimally. Choudhry (2017) surveyed 25 construction projects and collected 1,454 responses to show that workers do not always perceive the pursuit of safety performance as contradictory to the aim of raising productivity levels. In any case, virtually all the surveys were based on self-perception responses or self-reporting. Therefore, in relation to the quality of evidence, these studies constitute fairly weak evidence (see Figure 9 below).

> “The three most commonly used methods are modelling, self-reporting or self-perception survey, and case study research”

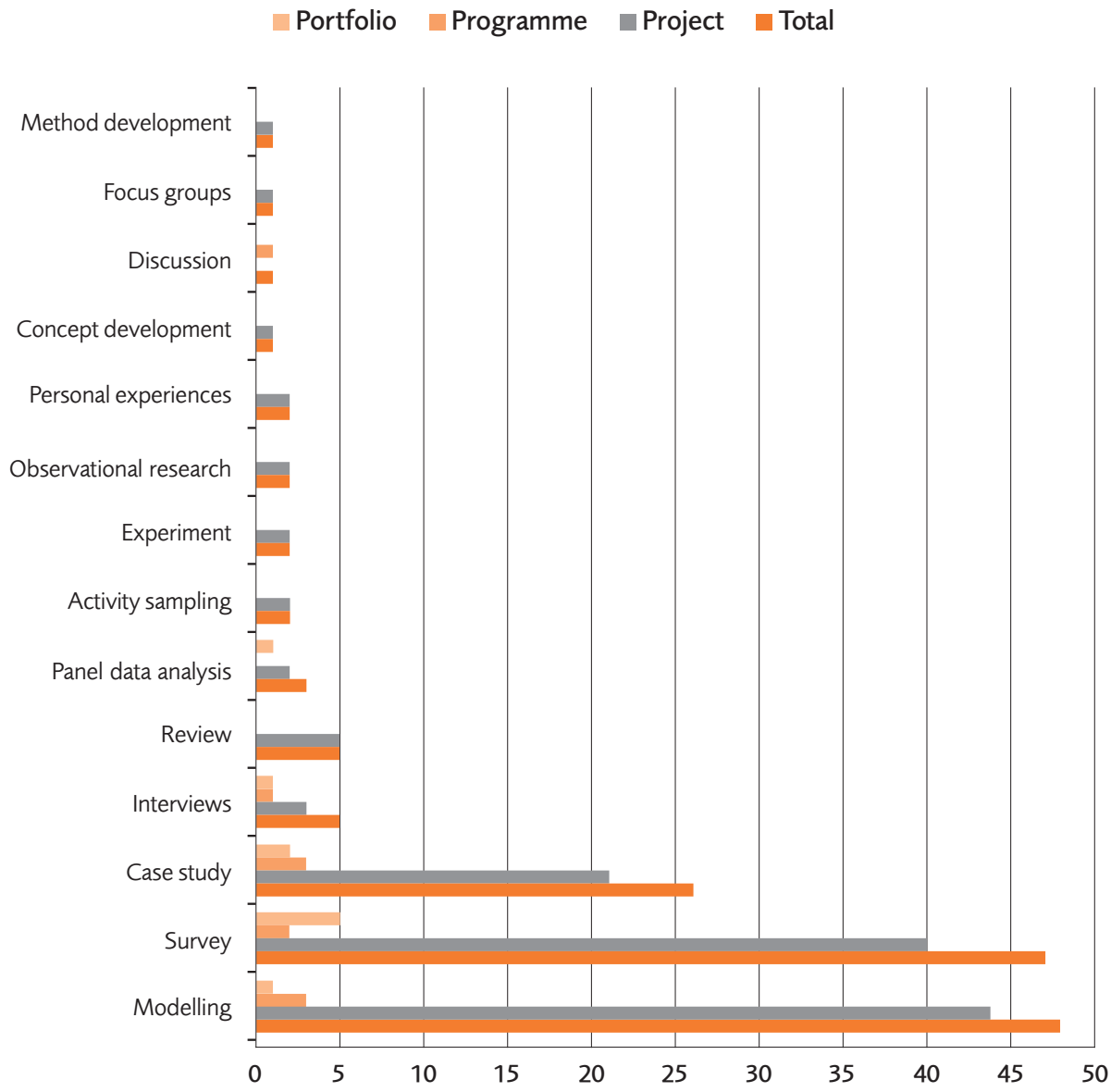


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Figure 8. Distribution of research methods used

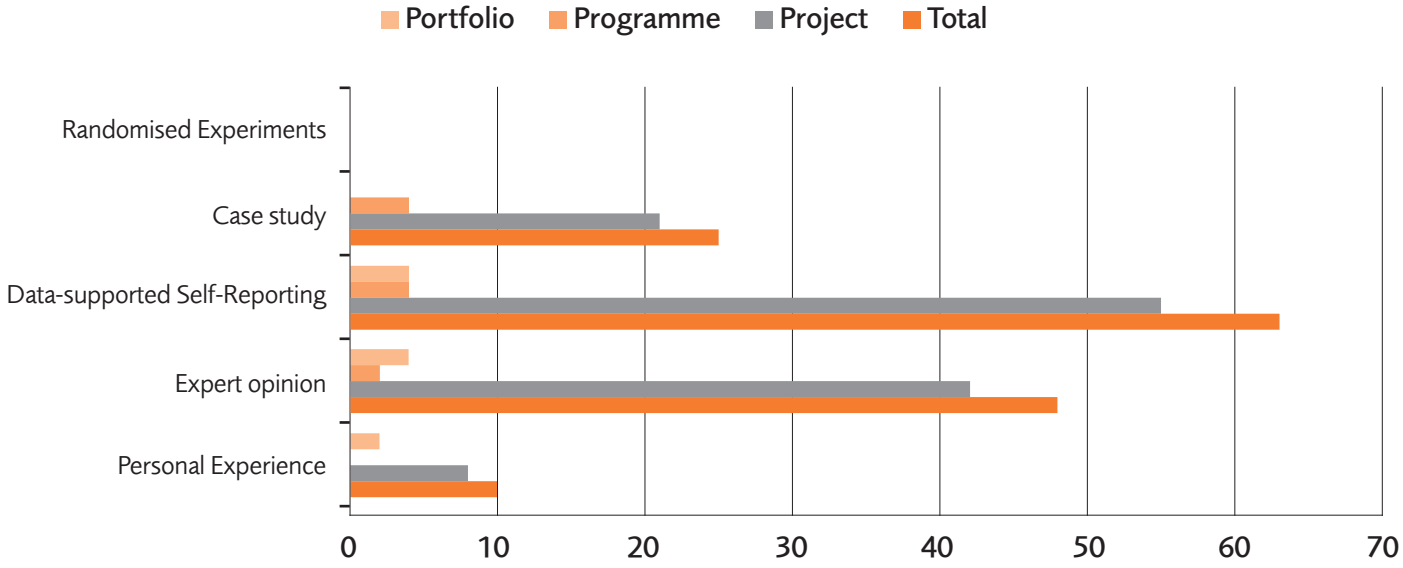

Figure 9. Distribution of strength of evidence

Focal areas

Figures 10–12 summarise the key focal areas found in previous studies. As already indicated in the thematic analysis of the research questions, more studies focused on defining and measuring inputs (ie factors) and outputs (ie productivity levels), with less attention paid to managing productivity throughout the process of the project life cycle. There is also an overwhelming emphasis of project management as a technique in previous studies. This is not surprising given how much research into project management, until recently, has been dominated by normative models, tools and techniques (see eg Pollack and Adler, 2015; Padalkar and Gopinath, 2016). Given how project management training and education is quite a regular feature in research, it is surprising to see so few studies that examined the relationship between project management education and productivity. As will be discussed in the next section, while there have been many studies that investigated the value of project management education, productivity is not usually regarded as one of the main outcomes of education.

> “It is surprising that so few studies examined the relationship between project management education and productivity”

Following the bundles of practices from Bloom et al (2012), it can be seen from Figure 12 that more emphasis was placed on monitoring and target setting activities than on incentivisation practices. This is an indication of what a number of critical scholars termed as the re-bureaucratisation of the project management function, where the setting of targets and pursuit of performance metrics trumps the pursuit of flexibility, creativity and innovation (see eg Metcalfe, 1997; Hodgson, 2004; Räisänen and Linde, 2004; Lenfle and Loch, 2010; 2017).

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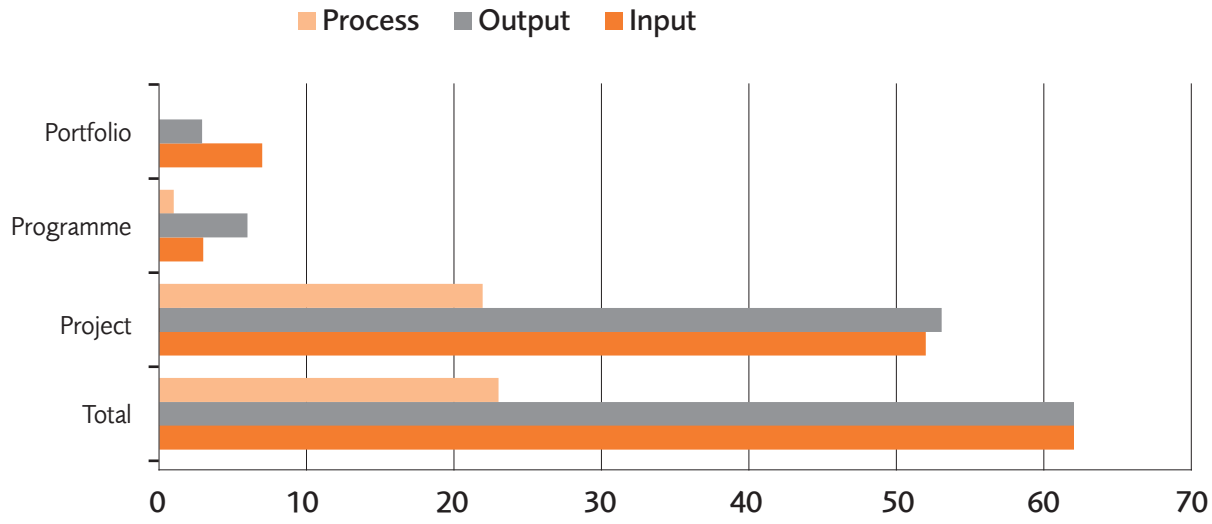

Figure 10. Distribution of focal areas: input-output-process

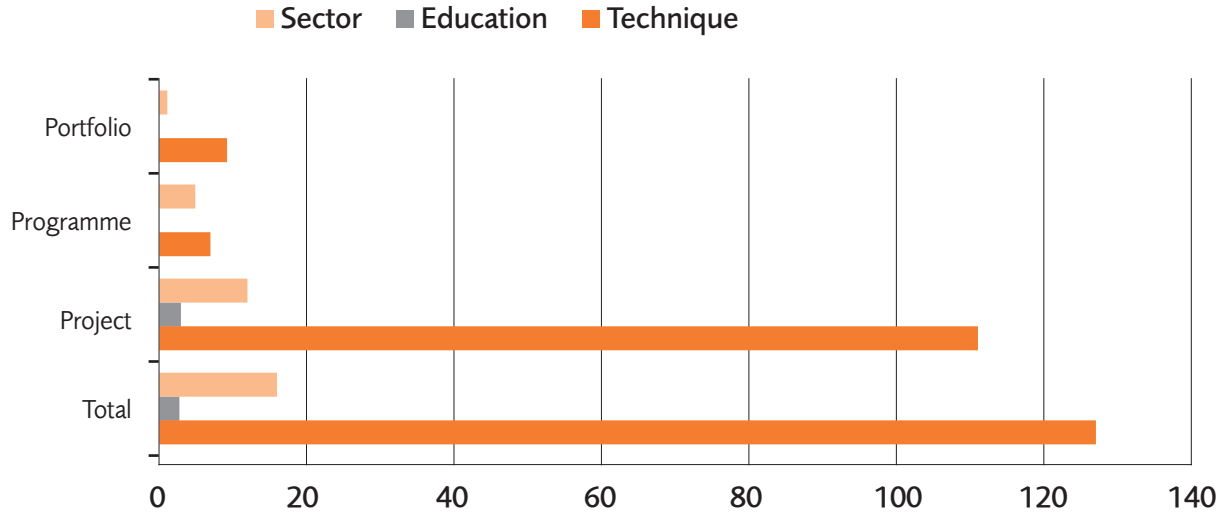

Figure 11. Distribution of focal areas: project management as technique, education and sector

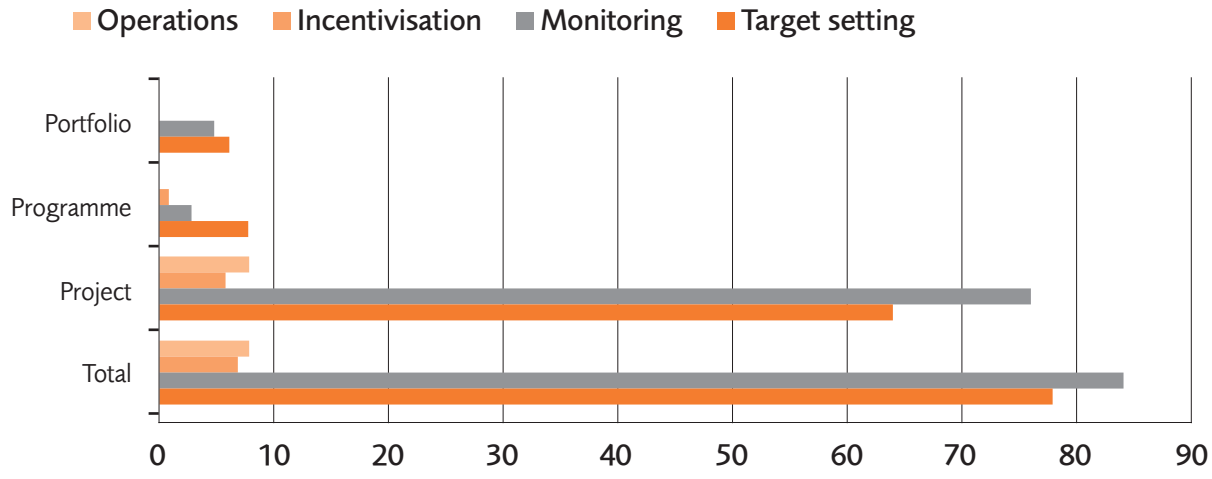

Figure 12. Distribution of focal areas: bundles of management practices

Figure 13. Word clouds illustrating definitions of productivity in project (left), programme (middle) and portfolio management (right)

Figure 14. Word clouds illustrating key terms used in framing research questions in project (left), programme (middle) and portfolio management (right)

Figures 13–14 above present word clouds that illustrate respectively the frequently used terms in the definition of productivity and the kinds of questions asked in previous research on productivity and project, programme and portfolio management. It is striking to see differences in the ways productivity is defined by researchers dependent on context. When relating to projects, the emphasis is either on counting outputs (eg number of products or tasks completed) or inputs (eg cost of resources) per working hour (see Figure 13, left). Although cost also features as a concern when thinking about productivity of programmes, the concept of value becomes more critical[5]. In the context of programme management, given that a number of studies focus on public sector programmes, the emphasis is more on wider impacts and outcomes rather than countable outputs and products (see Figure 13, middle). Value also features more strongly when thinking about productivity in the portfolio context. This is not surprising given the more strategic rather than tactical focus in portfolios. As a number of studies also examine new product development and innovation projects, productivity is also framed as first-in-market and translated to sales per employee (see Figure 13, right). Thus, at the project level, the focus on productivity is on more tactical matters, whereas the focus shifts away from task orientation to a more strategic focus at programme and portfolio levels of analysis. These are also reiterated in the kinds of research questions asked at the three different levels of analysis.

> “When relating to projects, the emphasis is on counting outputs or inputs per working hour”

5 The term “value” emphasised in the literature on programme management should be distinguished from the concept of “earned value” that is commonly found in project management bodies of knowledge. Whereas “earned value”, which typically evaluates schedule and cost variances, tends to focus on outputs, the term “value” used in the literature on programme management refers more to outcomes that are at times less tangible.

Discussion of results

There is no unified framework on how project management affects productivity. Approximately a third of the studies reviewed (n = 47) were based on self-perception surveys, often aimed at confirming a researcher's hypothesis that a particular issue mattered in terms of its contribution to higher productivity. Similarly, nearly another third of the studies reviewed (n = 48) were based on modelling factors deemed to be important to productivity. While the various issues highlighted in past research provided insights into how productivity can be improved, these rarely constituted an integrative framework that examines the contribution of project management on productivity. In most cases, these were simply studies in project-based contexts (eg construction and software development) rather than project management per se. Thus, as Bloom et al (2012) highlighted, finding associations between management practices and productivity is not often regarded as a hard science by many economists. Furthermore, rather than to pin down the exact relationship between project management and productivity, there is a tendency to find associations often through self-perceptions or self-reporting between project management and project success or performance (eg Mir and Pinnington, 2014). This is despite the challenge of defining what (high) performance means (Stone et al, 2012).

There is often the assumption that good, front-end planning is essential to avoid changes and rework in the project life cycle. In a study of 78 commercial information systems projects, Mahmood et al (1996) found that spending 3 per cent worth of an analyst time in front-end planning can result in saving twice as much in terms of development time. Based on the Construction Industry Institute's Engineering Productivity Metrics System, Liao et al (2011) analysed 112 heavy industrial engineering projects from 2002–2007 to find that front-end planning and a stronger focus on quality rather than schedule can lead to greater use of modularisation, which in turn increases productivity. In any case, front-end planning is just one side of the productivity challenge. As Mahmood et al (1996) stressed, those who spend more time monitoring performance throughout the project life cycle were also the ones who were found to be more productive.

The emphasis on front-end planning also meant that change and rework were often taken as proxies for measuring productivity. Variations were often regarded negatively by many researchers (eg Hanna et al, 1999; 2002; Song and AbouRizk, 2005; Ellis and Lee, 2006; Liu et al, 2011). The literature is thus dominated by studies that assume that planning for minimal changes is essential, and that we cannot manage what we cannot measure (Cigolini and Grando, 2009). However, this emphasis on planning is problematic for a number of reasons. First, given that projects are typically defined as unique, temporary, non-routine endeavours, it is often difficult to establish the baseline productivity level upon which to benchmark actual performance (eg Thomas and Završki, 1997; Thomas et al, 2002; Michalski, 2005; Zhao and Dungan, 2014). Add to that the labour-intensive nature of measuring productivity, this perhaps accounts for why there were so few

BOX 3: Design changes and productivity: converging too quickly?

Front-end planning has been regarded as an important part of the management of projects (Williams and Samset, 2010; Morris, 2013). The assumption is that early planning and involvement of stakeholders will lead to fewer surprises later on in the project life cycle. Previous studies have tended to focus on achieving design fixity early on in the life cycle. Consider the analysis by Stensrud and Myrtveit (2003: 407-408) who analysed 30 enterprise resource planning (ERP) projects. One of the projects observed, Project 48, was regarded as the most productive in terms of implementing a lot of SAP modules and several interfaces and conversions for many users with relatively little effort and short duration. Their conclusions were that in Project 48, the project team worked smarter and not harder. Rather than to ask users what they needed by gathering requirements in the usual manner, they were proactive and simply convinced the users: "This is what you need" and rolled out a preconfigured SAP solution.

Project 48 may be "productive", but it is not clear whether the end-users' needs were satisfied in the long-run. In another study of productivity in innovation projects across 95 electronics companies in the US, Japan and Europe in 1992–1993, Loch et al (1996: 16) found that project management as a methodology added value not in terms of closing down change, but in terms of managing concurrent project phases and changing specifications more often. The ability to change specifications frequently runs counter to the mantra of "Freeze specs early". Firms that had a higher rate of innovation were those that were able to update specifications more frequently.

In another example, Ward et al (1995) discussed the Second Toyota Paradox. Although Toyota uses concurrent engineering to freeze specifications quickly, Toyota's engineers and managers also try to delay decisions and provide their suppliers with hard specifications very late in the process. It turns out that delaying decisions on alternative designs can help avoid the delivery of sub-optimal solutions, which in turn allowed Toyota to make better cars faster (see also Ford and Sobek, 2005).

studies (n = 2) that were based on measuring actual productivity (eg Jenkins and Orth, 2002; Hajikazemi et al, 2016).

The second shortcoming of the planning fallacy is what is colloquially known as "Parkinson's law": that work expands to fill the available time. Thus, the act of setting a deadline itself can distort behaviour and skew levels of productivity. As Abdel-Hamid et al (1993) found, the mere act of estimating productivity can influence project behaviour in subtle, more indirect ways; if a project is perceived to be behind schedule, then workers may feel pressured to work harder in order to bring the project back on schedule. This is again exemplified in Chan and Kaka's (2007) study of productivity dynamics on construction sites where they found that the emergence of rework can actually increase worker's productivity. Therefore, one must exercise caution when thinking about planning for productivity. Researchers have often assumed that productivity can be managed simply by differentiating between productive and unproductive work (eg Jenkins and Orth, 2004), with the goal of maximising productive time at work. Yet, there is also a limit as to how much workers can sustain prolonged periods of high levels of productive work. More recently, there has been renewed interest in examining the impacts of rest on productivity. For instance, Barck-Holst et al (2015) studied the effects of reduced work hours in the social care sector in Sweden to find that workers were generally happier and less fatigued and stressed, with impacts of providing better quality care.

Third, the assumption that variations should be minimised is based on the traditional manufacturing paradigm where stability and standardisation were privileged in the quest to gain production efficiencies. More recently, a growing number of researchers have begun to adopt the view that change is an inevitable part of managing projects and that it is vital that project managers can proactively manage assumptions (Gao et al, 2014). Hornstein (2015) argued that project managers should be equipped with change management capabilities. Martinsuo and Hoverfält (2018) also called for more attention on building capability for managing change programmes with particular focus on delivering strategic value of multi-project change. Therefore, there is a need to view changes not simply as negative elements to be controlled and eradicated, but also as positive opportunities where project management can thrive (see also Box 3).

This stability-change paradox also featured in the studies reviewed. For instance, Polesie (2013) argued for the need to find a balance between pursuing standardisation on the one hand, and allowing a degree of freedom and flexibility for workers and managers on the other (see also Simard et al, 2018). Yet, Low and Teo (2004), in analysing two case study organisations of construction contractors in Singapore, found that project managers are often limited in their ability and discretion to make decisions at the corporate level (particularly decisions of a financial nature outside the boundaries of the project budget). Low and Teo (2004) found that empowering project managers to make decisions can help add value to processes, increase quality levels and raise productivity.

On emphasising the problem of variations, it is also worth noting that many studies tend to be based on repeatable tasks even if the investigation was done in a project-based industry. Take construction, for instance. Researchers have focused mainly on such repeatable tasks as pavement and sewage construction (eg Chua and Hossain, 2011; Panas and Pantouvakis, 2011) concrete and formwork operations (eg Thomas et al, 2002; Sacks et al, 2003) when studying productivity. In software development projects, focus is turned towards the number of software codes that can be produced per time spent. Thus, studies tend to focus on discrete, often repetitive (and repeatable) tasks rather than to address project management per se. There is often the assumption that more output in a shorter period of time (or with

fewer resources) is a good thing. For instance, producing more software programme codes is more important than the usability and usefulness of such codes (eg Narayanan et al, 2009; Unluturk and Kurtel, 2015).

Given the focus on repeatable tasks, there is an absence of studies that examine productivity outcomes of internal projects (eg organisational change). There are notable exceptions in the sample of studies reviewed. For example, Bach (1996) in a review of business process re-engineering projects found that productivity following an organisational change initiative is likely to decline for the first six months due to a necessary period of organisational adjustment. This is also known as the learning curve. Nevertheless, the absence of studies on productivity of change management projects is perhaps due to the problems of relating such contexts to conventional production measures like productivity. Ascertaining the value of change management projects can also be challenging since the management of change often entails not just technical matters but also social aspects too (see Box 4, right). Establishing the value of change requires asking questions that go beyond the counting of technical outputs. For instance, over what timeframe should an outcome be measured? What does "success" look like and from whose point of view? How is a "good" performance outcome framed? Is "productivity" even an appropriate measure to evaluate the management of change projects? That said, as organisational change becomes commonplace across the public, private and third sectors, this represents an opportunity to investigate what "productivity" means in the context of managing change.

Although training and education are regularly featured in project management research, it is surprising to see so few studies explicitly refer to the productivity outcomes of training and education. The only study found was Loo's (1991) survey of 120 project management firms that provide project management training. This survey found that in-house training was preferred to longer educational programmes because short in-house training was considered more time- and cost-effective. Interestingly, few respondents reported of (perceived) productivity benefits of training and education. In fact, many put more emphasis on the acquisition of new skills and new knowledge than on productivity benefits. Recent studies on project management training and education seem to support Loo's (1991) findings. For example, Ramazani and Jergeas (2015) found that the acquisition of new skills and knowledge was what drove participation in project management training and education, and the link with productivity was not explicitly studied. More recently, Blomquist et al (2018) found through their longitudinal survey of why practitioners take up project management certification that looking good and feeling good with certification were more important than being good. Nevertheless, Pollack and Adler (2014) found that employers preferred an educational qualification in project management compared to an MBA when developing project management capability, thereby reinforcing the distinctiveness between project management and mainstream management. There is still a need though to further investigate and develop more compelling measures for establishing the value of project management training and education.

BOX 4: A case of a counter-productive change project

Metcalfe (1997) reported on her participant observations of a change management project in DatCo. At that time, DatCo, a division of one of Britain's largest electrical and defence organisations with approximately 350 employees comprising mainly computing, system and design professionals, were introducing new project management software into the business. DatCo had experienced several long-run projects in software development and it was felt that an integrated strategic planning system would help identify critical project issues. Therefore, the motivation for introducing new technology/software was to establish strategic level programme management.

The implementation of this change was carried out through consultants – project managers like Metcalfe (1997). Change was also introduced in a top-down fashion. As the operations director commented, "The issue is to get it (project management) into place, not to communicate – people hate change". The result of this change was less than optimal. New project controls resulted in a series of sub-strategies by engineers and computing professionals that thwarted the effective utilisation of project management software.

Metcalfe (1997) argued that the failure of this change management project was due mainly to the top-down, non-participative way of implementing the change. Those who were most affected by the new project controls were effectively not engaged in the process as the senior managers simply treated the exercise as a change in the technical process. Furthermore, the use of external consultants who were not sufficiently embedded inside the organisation to see through the change as the project transitioned into business-as-usual was also another factor (see also Czarniawska and Mazza, 2003).

Conclusions & recommendations

The contribution of project management to creating a more productive workplace has often been assumed but rarely systematically reviewed. In this report, we presented the analysis from a systematic review of 146 published studies that attempt to draw the link between project management and productivity. A number of conclusions and recommendations can be made:

01 As expected, the literature is overwhelmingly dominated by studies on linking project management and productivity, with less attention paid to the relationship between productivity and programme and portfolio management. Where project management is concerned, productivity is often counted as quantity of outputs per time or resource spent. Studies have tended to focus on repeatable tasks, rather than project management per se. Where programme or portfolio management are concerned, productivity tends to be framed more in terms of strategic value and outcomes rather than tangible outputs. **Recommendation:** There is a need for much broader definition of what "project management" means that goes beyond the tactical to the strategic. A more strategic view will allow for a much broader evaluation of the contribution projects and project management make to the wider economy and society[6].

02 Productivity measures in studies of project management appear to be based on a traditional manufacturing/production paradigm. The emphasis seems to be on time-based measures. Productivity is thus about getting more out of the (human) resources. However, this ignores recent debates about work time and the need to work smarter and not necessarily harder. Moreover, time-based measures may not be as relevant in post-industrial contexts where the focus shifts away from counting outputs to figuring out what outcomes should count. This is also perhaps why laborious attempts to measure productivity (eg through activity sampling techniques) are rarely reported. A more strategic conversation about value also appears to be the focus when discussing programme and portfolio management. **Recommendation:** Associated with a more strategic framing of "project management", there is a need to develop new measures of "productivity" that take into account a more holistic understanding of value and outcomes.

03 More emphasis has been placed on examining practices of target-setting and monitoring of productivity than on incentivisation. This is in line with studies on relating management practices and productivity. This also reflects the difficulties of incentivising performance either because of the Hawthorne Effect (i.e. behaviour is distorted simply by observing that behaviour) or because incentives can result in game-playing, which in turn can lead to unintended and undesirable consequences. **Recommendation:** There is a need for closer inspection of how incentivisation for productivity works in the management of projects, programmes and portfolios.

04 Research has hitherto focused on particular issues, eg the importance of front-end planning, and productivity. There is no integrative framework that captures a holistic picture of how project management practices affect productivity. This is because of the dominance of self-reporting surveys and modelling. Although case study research is also commonly used, it is not clear how promising practices identified in these studies can be replicated. **Recommendation:** There is a need for systematic case study research that zooms into how particular practices over the whole project life cycle can impact on productivity outcomes.

05 Studies have mainly focused on particular sectors, namely construction and information systems. These do not adequately capture the range of contexts where the management of projects applies. Given the growing prominence of project-based working in knowledge-based work, there is a need to investigate how project management can add value in these contexts. **Recommendation:** There is a need for studies in knowledge-based work found outside the traditional production sectors, and these include eg the services sector, public sector and third sector.

06 The study of how project management contributes to delivering organisational change is an under-examined and overlooked area. To date, a single review study was found to explicitly link project management to a business improvement context. However, change projects cover a broad range, from internal improvement initiatives to the introduction of new technologies and work practices, and wider inter-organisational change projects (eg mergers and acquisitions). **Recommendation:** There is a need to examine how project management can add value to delivering a broad range of intra- and inter-organisational change.

07 There are many studies that rely on self-perception data. Therefore, there is a need to move beyond understanding perceptions to examining the realities of how project management contributes to productivity. Perceptions can nevertheless be significant motivators of performance. Thus, there is also the need to consider how non-project managers perceive the value of project management to be. **Recommendation:** There is a need for studies into how non-project managers perceive the value of project management practices.

6 See also the APM and PwC study on the contribution of projects and project management to the UK economy, due late autumn 2018.

What next?

Three possible actions can be considered as a consequence of this systematic review:

Linking micro-level practices of managing projects and macro-level measures of performance:

Given a lack of studies evaluating the productivity impacts of the everyday practices of managing projects, more in-depth investigation of micro-level project practices is needed. Demonstration projects would be required so that comparative analysis can be undertaken to show if and how productivity levels can differ between projects that deploy superior project management practices and those that do not[7]. These demonstration projects can then form a suite of learning legacies that project management professionals can draw upon (eg the learning legacies from high-profile projects such as Heathrow Terminals 2 and 5, London Olympics and CrossRail). These demonstration projects should also capture how project practices can yield valuable outcomes beyond project and firm (or inter-firm) productivity. Linking micro-level project practices with broader performance measures is in part the aspiration of the APM and PwC study on the contribution of projects and project management to the UK economy.

Evaluating productivity of organisational change projects:

Project management is increasingly used to manage organisational change projects. The context of managing change projects is unlike projects in traditional production sectors in that more intangible outcomes are involved. More case studies can be developed to show how managing organisational change effectively as projects can lead to productive outcomes. A recent example can be found in Staffordshire Fire and Rescue Service's journey of change where the use of systems thinking has led to dramatic reductions in callouts and fatalities (see www.apm.org.uk/news/staffordshire-fire-and-rescue-service-a-journey-of-change-webinar/). The case studies should also identify the challenges faced by project managers in managing change, and the exemplary practices of overcoming these challenges.

Start thinking flexibly with the outcomes in mind:

The project management profession has often, at least in principle, emphasised the importance of getting the plan right. Put simply, to achieve the intended productive outcomes, project managers need to plan first and plan well. Such a linear view can, however, be seen to be top-down and rigid. This also downplays the possibilities of unintended consequences (eg productivity gains in a project may lead to inefficiencies and bottlenecks in a programme). In an analysis of innovation projects at Shell over a nine-year period, Ramírez et al (2011) found that the effective management of these projects relied on a combination of top-down and bottom-up measures. While there was a strategic, top-down plan to encourage innovation in Shell through their "GameChanger" process[8], Shell also created "domains" from the bottom-up. These domains were based on mapping the innovation projects alongside future scenarios that emerged from discussions with scientific experts working with innovation teams in Shell. Only when a domain is accepted does it then get managerial responsibilities and a budget/cost code. Thus, from a bottom-up approach, the innovation projects pre-exist the domains that structure the organisation of these projects. Put another way, Shell also thought of the outcomes first (ie innovation projects and future scenarios) before putting the planning in place (ie the managerial infrastructure in the "domains").

7 While the definition of what "superior" means in terms of evaluating project management practices can be subjective, one can draw inspiration from the literature on capability maturity levels (ie Level 1 being ad hoc and Level 5 being optimised). This framework is also the basis that informed the studies of Bloom et al (2012) and Bender et al (2016). **8** The Shell GameChanger process was designed to enable Shell to explore possible exploitations of emerging technologies to meet the future business needs of Shell.

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Appendix:

List of studies included in the systematic review

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