



Six decades of project management research: Thematic trends and future opportunities

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Abstract

Project management as a discipline possesses a rich body of literature characterized by early determinism and later expansion to broader contexts aided by paradigmatic, thematic, and methodological diversity. The dynamic nature of research entails many parallel streams of enquiry under differing perspectives without convergence to parsimonious theories. We argue that an integrated view of project management research in terms of its thematic evolution and trends is necessary for an understanding of future directions. Our study fills this gap by tracing the evolution of themes in project management research, trends, and future opportunities through a systematic review of literature. We find the research to be dominated by empirical and deterministic perspectives while non-deterministic research enquiry remains weak and sporadic. We contend that stronger focus on non-deterministic perspective and a methodological convergence is necessary for the research to meaningfully advance towards theory building, and discuss potential avenues for further research.

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1. Introduction

For at least six decades, project management (PM) has been an established discipline with well-subscribed bodies of practitioners and commonly accepted methodologies and standards such as PMBOK® and PRINCE2®. The field of PM is diffuse and multi-disciplinary (Pollack and Adler, 2015) and offers a considerable body of literature in large number of peer-reviewed and practitioner journals, as borne out by several reviews (Kolisch, 1996; Pinto and Slevin, 1988; Kloppenborg and Opfer, 2002; Herroelen and Leus, 2004, 2005; Crawford et al., 2006; Kwak and Anbari, 2009). Research interest in PM has surged over the past 15 years, leading to steady growth in number of published articles as well as in diversity of research

enquiries, domains, and methods (Söderlund, 2004b; Hall, 2012; Turner et al., 2013).

Despite the large quantum and the diversity of PM research, the field lacks convergence in two key areas. First, a well-subscribed stream of research on success or failure factors (Cooke-Davies, 2002; Jugdev and Müller, 2005; Ika, 2009; Müller and Jugdev, 2012) suggests an unfinished nature of the search for explanations of project performance. Many surveys, case studies, and anecdotal evidence also lend support to this observation (Pinto and Slevin, 1988; Whittaker, 1999; Yeo, 2002; Matta and Ashkenas, 2003; Nelson, 2007; Chua, 2009; Jugdev et al., 2013). Second, several authors point to weak theoretic foundation of the discipline (Shenhar, 2001; Söderlund, 2004a; Cicmil et al., 2006; Smyth and Morris, 2007; Whitty and Maylor, 2009; Morris, 2010) and argue for reexamination of the present research agenda. Calls for improving relevance of research to practice and for adopting diverse paradigms or methodologies have also appeared at regular intervals (Pollack, 2007; Hodgson

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and Cicmil, 2008; Morris, 2010). Thus, without strong theoretic foundations, it is difficult for the research to converge to parsimonious outcomes necessary for utility to practitioners.

The field of PM has relevance across many industry sectors and contexts (Carden and Egan, 2008), hence PM research appears in a large number of journal outlets. In absence of strong theories, the growth in research interest coupled with the scattering of research in diverse outlets could lead to a proliferation of outcomes and thematic divergence. Such proliferation comes at the expense of parsimony and impedes theory development, apart from a reduced relevance to practice. It is therefore necessary to aggregate and organize the extant PM research into meaningful schema, and elicit trends that inform on future directions for research. This forms the motivation for our study. Through a two-part review of PM literature, we examine the following questions:

RQ1: What themes characterize the evolution of PM research over the past decades?

RQ2: How are these themes reflected in recent PM research?

RQ3: What themes are trending presently? What directions for future research do they indicate?

During the six decades of existence as a discipline, PM has seen numerous literature reviews. However, most of them limit their scope to specific themes, short periods, or a subset of journal outlets. For eliciting general trends, we expect the reviews to analyze large samples, given the quantum of available PM literature. Indeed, only a few examine large bodies of literature over longer periods. We discuss them briefly in reverse chronological order.

In a most comprehensive study so far, Pollack and Adler (2015) use software-based scientometric techniques to analyze 94,472 unique records taken from Scopus and ISI Web of Science over 1962–2012 and show clusters of top keywords used in the abstracts and their evolution over time. They analyze physical co-occurrence of terms to form semantic clusters which offer basis for thematic sense making. Kwak and Anbari (2009) examine 537 papers over 1950–2007 from 18 peer-reviewed and practitioner journals from 8 allied management areas such as OR/DS/OM/SCM, OB/HRM, IT/IS, etc., excluding PM-focused journals. Their analysis shows strong decadal growth in PM research from 1980s in all areas, with Strategy/PPM as the leading area of growth. Artto et al. (2009) use bibliometric methods to study 1164 articles related to project management from 23 business journals over 1986–2006 and show ‘Product development’ and ‘Organization and product design’ as the top themes in PM research; and ‘Innovation,’ ‘Performance,’ and ‘New product development’ as the top keywords. However, by excluding PM-focused journals, it is not clear how the findings are applicable to mainstream PM research. Crawford et al. (2006) use linguistic analysis of keywords to study 1051 papers over 1994–2003 from International Journal of Project Management (IJPM) and Project Management Journal (PMJ). Using a classification scheme to associate a cluster of keywords with a priori topic definitions they show themes such as ‘Project evaluation and

improvement’ rising in significance and ‘Quality management’ declining over the study period. Kloppenborg and Opfer (2002) use keywords from abstracts to analyze 3554 articles from several databases over 1960–1999. Using frequency analysis, their study maps keywords to industries and to PMBOK® knowledge and process areas to find most frequently used terms: ‘Cost,’ ‘Time,’ ‘Quality,’ ‘Risk’ in the knowledge areas; ‘Plan,’ ‘Control’ in process areas; and ‘Construction,’ ‘Information systems’ in the industry domains.

We observe that most of the above studies use keywords or derived categories as proxies for themes and employ counting or scientometric methods. They generally do not extend to semantic analysis for deriving the thematic trends, nor propose models or classification frameworks to situate extant body of knowledge and to inform on future research directions. We argue that keywords by themselves are not sufficient to derive the themes or trends. Themes are derived from the contexts and meanings within which the keywords are used; and trends are temporal progressions of influence gathered by such themes within the academic and practitioner communities. Our study attempts to bring out the themes and trends through a two-part systematic review of literature.

This paper is organized as follows. In Section 2, we describe the research design and methodology. Section 3 presents the results and analysis from the two-part review. Discussion of results follows in Section 4. We conclude with the limitations and future implications of our study in Section 5.

2. Research design and methodology

2.1. Design considerations

To address the research questions posed in the previous section, we adopt a two-part review process.

Part 1 addresses RQ1 by noting that the quantum of qualifying articles for our review would be very large and scattered, as PM research dates back to the 1950s and is featured in a large number of journal outlets. To overcome this challenge, we adopt a historiographic approach based on prior literature reviews to synthesize key themes from PM literature. We observe that literature reviews are ‘historical records of meta-narratives’ appearing at various points of time (Greenhalgh et al., 2005, p. 420; Sylvester et al., 2013, p. 1201); and serve multiple purposes: a) to organize an accumulated body of research into key concepts, b) to synthesize models or classification frameworks to guide future research, and c) to reveal gaps or emerging issues that merit further investigation (Webster and Watson, 2002; vom Brocke et al., 2015; Jennex, 2015).¹

Part 2 addresses RQ2 and RQ3 and examines contemporary PM literature to propose a classification framework, draw inferences on the trends, and posit areas worthy of further investigation. Despite the dispersed nature of PM research, we note that PM-focused journals account for the major share of its

¹ For examples of such approach see Crawford et al. (2006), Greenhalgh et al. (2009), Thome et al. (2015).

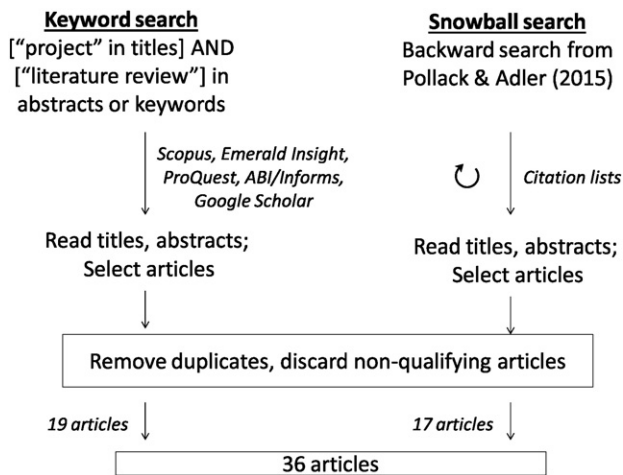


Fig. 1. Sample formation for Part 1 review.

publication. It is therefore reasonable to assume that the main themes and their movements will be captured in the PM-focused, peer-reviewed journals. Accordingly, we choose IJPM, PMJ, and International Journal of Managing Projects in Business (IJMPB) as the sources, and set 2000–2015 as the duration to align with Kloppenborg and Opfer (2002). As trends constitute influential articles, we focus on highly cited articles from these journals.

2.2. Research methodology—Part 1 review

Part 1 consists of synthesis of prior reviews of PM literature. As these could be featured in diverse journal outlets, we followed a combination of backward snowball and keyword searches on major databases to assemble the sample for Part 1 review (Fig. 1). We preferred literature reviews having broader scope and excluded single journal reviews, reviews with geographical limitations, or those having restricted scope.²

For backward snowball searches, we began with Pollack and Adler (2015) as the most recent large-scale study on PM trends and extracted qualifying articles from its bibliography. These in turn were browsed to extract further articles iteratively, until no new articles turned up. This process yielded 17 articles. In parallel, major databases Scopus, ABI/Informs, ProQuest, Emerald Insight, and the search engine Google Scholar were searched by using keywords [‘project’ in article titles AND ‘literature review’ in abstracts or keyword lists]. This process yielded 27 articles. After eliminating duplicates with the results from the snowball search, the final sample consisted of 36 literature reviews from 11 peer-reviewed journals (Appendix 1).

2.3. Research methodology—Part 2 review

For Part 2 review, we extracted all articles from the chosen journals IJPM, PMJ and IJMPB over 2000–2015.³ As these

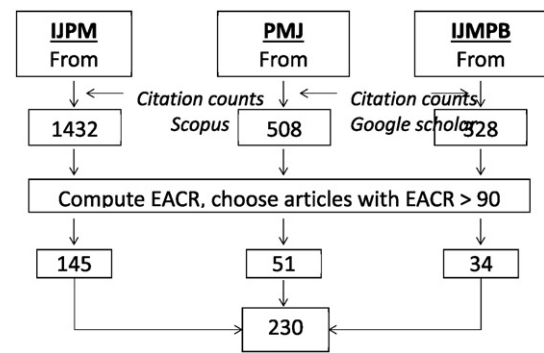


Fig. 2. Sample formation for Part 2 review.

journals were offered on different databases, we obtained the citation information, abstracts, and citation counts from different sources. We accessed SCOPUS database for IJPM, EBSCOHOST services for PMJ, and Emerald Insight for IJMPB to extract 1432, 508, and 328 articles respectively (Fig. 2). The citation counts for IJPM were taken from Scopus, while Google Scholar provided the citation counts for PMJ and IJMPB.⁴

Next, we needed a normalized measure of research influence. We noted that measures of research influence such as Journal Citation Reports, or SCImago Journal & Country Rank take a cross-sectional approach, i.e. the impact factors are ratios of total citations received for a journal to all articles from the journal usually over a fixed period of 2–5 years (Saha et al., 2003; Falagas et al., 2008). This method does not support arbitrary sets of articles spread over journals and years. To overcome this limitation, we defined Effective Annualized Citation Rate (EACR) as a measure of influence for articles published in a given year. EACR controls for the age of an article from an arbitrary set that may be drawn from different journals, and is comparable across years.

$$EACR_t^Y = \frac{\sum_{j=1}^{P_t} \sum_{i=t}^{2015} C_{ij}}{P_t \cdot (Y-t)} \quad (1)$$

where

Y Year of reckoning = 2016

t Year of publication 2000,...,2015

C_{ij} Count of citations during year i for j^{th} article published in year t

P_t Count of articles published in year t

Next, we ranked all articles in descending order of EACR, and chose articles whose EACR exceeded the 90-percentile mark.⁵ This process resulted into a sample of

² E.g. Betts and Lansley (1995), Themistocleous and Wearne (2000), Calderon and Ruiz (2015) were excluded.

³ IJMPB commenced publication from 2008. Hence the period was taken as 2008–2015.

⁴ Citation information accessed on 29–31 January 2016.

⁵ Citations were not comparable across the journals owing to differences in the accounting practices of source databases. Hence 90-percentile articles from each journal were chosen separately.

230 highly cited articles for Part 2 review, consisting of 145, 51, and 34 articles from IJPM, PMJ, and IJMPB respectively.⁶

3. Analysis and results

3.1. Part 1 review

Each literature review in the selected sample (N = 36) was examined for its thematic perspective. The following perspectival clusters emerged:

1. *Deterministic*: Eleven articles reviewed deterministically grounded themes, prescriptive methodologies, or models having a priori conceptual, heuristic, or theoretic basis. Examples of such themes included scheduling, resource-constrained or time/cost constrained scheduling, control methods such as earned value analysis, etc.
2. *Seeking explanations*: Fifteen articles reviewed empirical studies seeking to establish linkages between variables of interest based on primary or secondary data. These articles aggregated the available evidence into prescriptions, models, or frameworks for utility to practitioners. Themes covered in this cluster included success or failure factors, leadership styles, human resource management practices, stakeholder theories in practice, and effective control practices.
3. *Non-deterministic*: Five articles focused on themes dealing with non-deterministic aspects of the project phenomena. Typically, these themes addressed complexity, uncertainty, interdependence between project entities, managing risk etc., in the project phenomena.
4. *General themes*: Five articles examined themes of general interest such as typology of research in non PM-focused journals, PM research across industry sectors, distribution of research by PMBOK® areas etc.

To address the first question posed in this paper, we studied the time domains of the 36 selected articles (Fig. 3).

A timeline view shows that the three clusters—Determinism, Seeking explanations, and Non-determinism—are distinct in their starting points and centroids, while the General themes cluster spans the entire duration of study. Thus, we posit three distinct but overlapping eras in PM research:

- *Deterministic era*: Since early '60s, PM research has been characterized by deterministic themes with a dominant focus on scheduling and its variants (Willis, 1985; Icmeli et al., 1993; Kolisch, 1996; Herroelen et al., 1998; Brucker et al., 1999). Deterministic research appears to have peaked during early '80s, and continues at a reduced pace.

Under the prevailing deterministic view, projects were measured by how well they performed on the 'iron triangle' of cost, schedule, and quality (Atkinson, 1999), and efficiency

was sought through optimized scheduling of project activities, which were assumed to have fixed and deterministic attributes (Kolisch, 1996). Resource constrained scheduling was the most subscribed theme during this period. Scheduling algorithms, methods and conceptual models focused on optimization of project parameters such as time, cost, and resources were the main research outcomes during the deterministic era, as evidenced from many meta-studies. For instance, Icmeli et al. (1993) survey 56 papers on project scheduling from 1973 to 1991 and report that most research concentrated on three problem archetypes: resource constrained scheduling (RCPSP), time–cost trade-off (TCTP), and payment scheduling (PSP). Kolisch (1996) and Herroelen et al. (1998) review resource constrained project scheduling methods, with the former examining series and parallel configurations. Kolisch and Padman (2001) review nearly 250 papers on deterministic project scheduling in terms of methods, models, algorithms and heuristic techniques. Herroelen and Leus (2004, 2005) survey robust and reactive scheduling methods; and scheduling under uncertainty. Hartmann and Briskorn (2010) survey nearly 200 papers to provide an update on the variants and extensions of resource constrained scheduling problems.

Even during the deterministic era, a small research stream focusing on the non-deterministic aspects in the project phenomena is evident. Authors have questioned the assumption of fixed activity parameters (MacCrimmon and Ryavec, 1964; Schonberger, 1981), and have proposed several methods of modeling uncertainty in scheduling (Martin, 1965; Burt, 1977; Cook and Jennings, 1979; Williams, 1992; Bowman, 1995; Cho and Yum, 1997; Elmaghraby et al., 1999; Chapman and Ward, 2000). Herroelen and Leus (2005) provide a detailed review of literature on scheduling under uncertainty. However, this stream did not receive much attention by the researchers until 2000.

- *Explanatory Era*: From mid-'80s, the research focus appears to have shifted towards seeking explanations of project phenomena. The explanatory era makes a departure from the conceptual MS/OR methods and employs empirical methods to search for antecedents of project performance. These include studies on generic success factors (Jugdev and Müller, 2005; Ika, 2009; Müller and Jugdev, 2012), antecedents to project success such as leadership styles (Turner and Müller, 2005), learning in project management (Tesch et al., 2003), project control (Rozenes et al., 2006), managing stakeholders (Littau et al., 2010), and human resource management in project-oriented companies (Huemann et al., 2007). The research under this era focused on definitions of project performance and success, success and failure criteria, and antecedents of project performance (Söderlund, 2004a, p. 186), and yielded a proliferation of variables, factors and practices as antecedents of project outcomes. Apart from meta-studies on success factors (Jugdev and Müller, 2005; Ika, 2009; Müller and Jugdev, 2012), we also see causal sub-themes such as leadership styles as antecedents to project success (Turner and Müller, 2005), effective project practices (Tesch et al., 2003), project control (Rozenes et al., 2006),

⁶ Complete bibliography with authors.

- tractable. The non-deterministic research relaxes the assumption of tractability.
- The three eras differ in their ontological assumptions. The deterministic era views the phenomena through a reductionist lens under the 'hard' paradigm (Pollack, 2007, p. 268), employs conceptual/analytical models, and delivers efficiency-focused methods such as optimization of cost or time. In contrast, the explanatory era sees divergence, and employs empirical methods yielding a large number of variables, factors, methods, and practices. The non-deterministic era with its emphasis on complexity theoretic constructs such as emergence and non-linear feedback loops (Benbya and McKelvey, 2006; Winter et al., 2006b; Whitty and Maylor, 2009) and project organization (Söderlund, 2004a) argues for a blend of empirical and conceptual approaches.
 - The concurrence of the three eras from mid-'90s and the growing thematic diversity suggests weak ontological, epistemological, or methodological convergence in PM research.

3.2. Part 2 review

The population of articles in the three chosen journals (N = 2268) shows continuous growth over 2000–2015 in absolute quantum, however, the influence per population article shows continuous decline over the decade 2006–2015 (Fig. 4).

Each paper in the sample of highly cited articles (N = 230) was reviewed and coded according to a structured scheme consisting of: Thematic perspective, Knowledge area, Theme, and Research question (see Appendix 2 for the coding structure and explanation of codes). The coding process followed Wolfswinkel et al. (2013) and required 4 iterations. The first two codes, i.e. Thematic perspective, and Knowledge area were subjected to inter-coder reliability checks by drawing two sub-samples of 45 papers using Monte Carlo methods. These were independently coded by two researchers who were at advanced stages of their doctoral programs and were familiar with the PM area. For this purpose, a sheet defining the terms and coding procedure was provided, and the author(s) personally explained the coding procedure to the two researchers. After reconciling the differences with the two raters, the Percent

agreement (98.2%, 91.1%) and Cohen Kappa (0.979, 0.867) values met the acceptance criteria (Lombard et al., 2015, p. 593).

3.2.1. Analysis of research trends

The sample of highly cited articles (N = 230) also shows a similar but slower declining trend. A comparison across the thematic perspectives shows that the decline is evident across all three perspectives: Deterministic, Explanatory, and Non-deterministic (Fig. 5).

The steady decline in EACR in Fig. 5 indicates exhaustion of the older themes as well as weak influence of new themes; and prompts an examination of the research themes from the sample of highly cited articles. From a total of 34 themes, we pick top 17 themes based on their EACR values, and examine three sub-periods: 2000–2005, 2006–2010, 2011–2015 to form longitudinal view of thematic evolution (Table 1).

Under the deterministic perspective, Project methods, Project strategy, and Knowledge management are the major themes over 2000–2015. Research under the explanatory perspective addresses a large number of themes. These include (in the descending order of influence): Success factors, Performance management, Project methods, and Risk management. Other themes include Governance & control, Knowledge management, Stakeholder management, and Public private partnership. The non-deterministic perspective is the smallest of the three, and deals with Risk management, Project complexity, and Project uncertainty as the main themes. Themes such as interdependence with project environments and external contexts are also addressed under the non-deterministic perspective; however these appear sporadically during the period.

To examine the nature of these themes, we reviewed the research questions posed in each article in the sample. In almost all cases, the research question could be extracted from the article's title. In a few cases, it required studying the article abstracts. Table 2 lists key research questions for the thematic trends identified under each perspective.

We briefly discuss the research motivations under the leading themes over 2000–2015. As the largest theme, Project methods are mainly viewed through the deterministic perspective and address topics such as critical chain (Herroelen et al., 2002; Raz et al., 2004; Cohen et al., 2004), budgeting and control (Anbari,

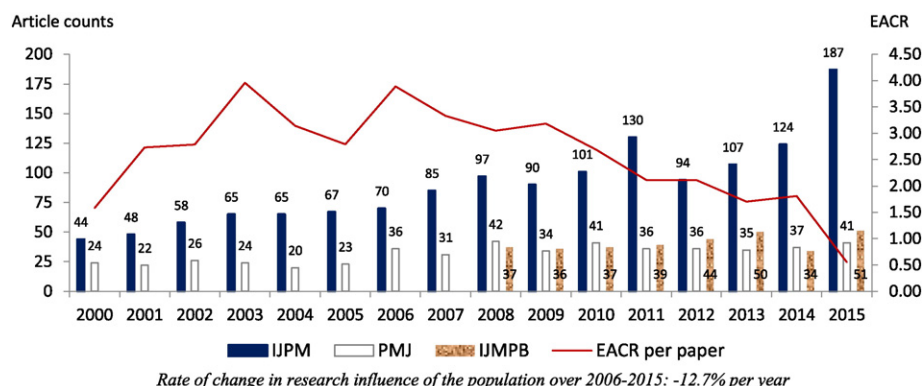


Fig. 4. Population counts of articles from select journals and population EACR (N = 2268).

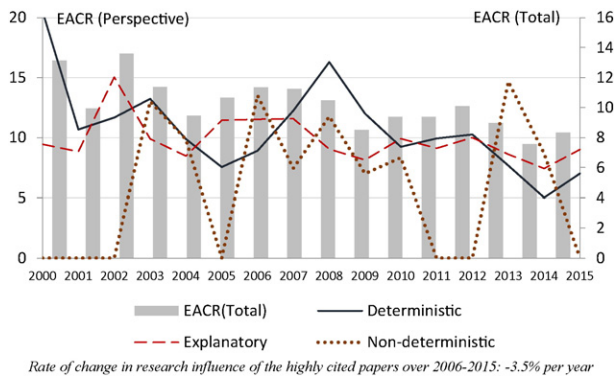


Fig. 5. Research influence of highly cited articles (N = 230).

2003), forecasting (Vandevoorde and Vanhoucke, 2006), project management maturity (Kwak and Ibbs, 2000); and methodologies such as Analytic Hierarchy Process (Bertolini et al., 2006), Multi-criteria Decision Making (Lee and Kim, 2001), Design Structure Matrix (Danilovic and Browning, 2007), and Balanced

Scorecard (Milis and Mercken, 2004). Project methods are also viewed through the non-deterministic lens employing fuzzy logic (Leu et al., 2001; Lin and Chen, 2004; Hsieh et al., 2004) or statistical methods (Lipke et al., 2009). Project methods decline continuously over the three periods 2000–2005, 2006–2010, and 2011–2015 in count of articles as well as the influence.

Success factors are mainly studied through the explanatory perspective. This theme is grounded in empiricism and dates back to mid-'80s. It is perhaps the most engaged theme in academic and practitioner journals. It has yielded a large number of variables and does not show signs of convergence. A brief scan of well-cited papers reveals the lack of parsimony in this theme: 14 factors (Pinto and Slevin, 1988); 12 factors (Cooke-Davies, 2002); 16 factors (Zwikael and Globerson, 2006); 18 factors and 80 sub-factors (Ngai et al., 2008); and 22 factors (Cserhádi and Szabó, 2014).

Project risk is addressed mainly through explanatory and non-deterministic perspectives. We find two variants of this theme in literature. Explanatory perspective offers mainly descriptive research, compiling case studies discover contextually bounded

Table 1
Distribution of 17 themes by perspectives and time periods (Main themes in boldface).

Period	Deterministic	Explanatory	Non-deterministic
2000–2005	<i>Project methods</i> Success factors Risk management Public private partnership Knowledge management Project organization Program management Project environment Stakeholder management	<i>Project methods</i> <i>Success factors</i> Performance management Resource management <i>Risk management</i> Partnering Project environment <i>Knowledge management</i> Project scope <i>Public private partnership</i> Team integration	Project environment <i>Project methods</i> <i>Risk management</i>
2006–2010	<i>Project strategy</i> Project culture Collaboration with customers <i>Project methods</i> Research methods <i>Public private partnership</i> Human resource management Program management office Project portfolio management <i>Risk management</i> Project management education	<i>Success factors</i> Project strategy <i>Governance & control</i> <i>Performance management</i> Program management <i>Project methods</i> Project environment Project portfolio management Project resources Procurement <i>Public private partnership</i> <i>Risk management</i> <i>Stakeholder management</i> Team integration Change management <i>Knowledge management</i> Industry-related Regional themes	<i>Risk management</i> Project complexity Project uncertainty Project strategy Project management education Project methods
2011–2015	<i>Knowledge management</i> <i>Performance management</i> <i>Project strategy</i> <i>Governance & control</i> Procurement Communication Project methods Quality management	Project management office <i>Success factors</i> Project methods Project team dynamics Project portfolio management <i>Knowledge management</i> <i>Performance management</i> <i>Risk management</i>	<i>Risk management</i> Project complexity Governance & control Project uncertainty

Table 2
Research themes and questions.

Theme	Deterministic	Explanatory	Non-deterministic
Governance & control		Relationship between control techniques and portfolio performance (Muller et al., 2008) Cultural differences and decision making (Muller et al., 2009)	Risk and uncertainty in megaprojects (Sanderson, 2012)
Knowledge management	Knowledge competencies in project organizations (Kasvi et al., 2003) Knowledge sharing contexts (Fernie et al., 2003) Tacit knowledge acquisition and sharing (Koskinen et al., 2003) Types of project knowledge (Gasik, 2011)	Integration processes in cross-functional projects (Huang and Newell, 2003) Social practices (Bresnen et al., 2003) Knowledge creation in interdisciplinary project teams (Fong, 2003)	
Performance management		Managing internal development projects (Elonen and Artto, 2003) Relationship between standards and performance (Crawford, 2005) Use of project portfolio management tools in project outcomes (De Reyck et al., 2005) Method to align intangible outcomes (Nogeste and Walker, 2008) Systematic biases and influence of culture in project outcomes (Shore, 2008) Project management maturity (Yazici, 2009) Key performance indicators (Ogunlana, 2010) Causes of delay in construction projects (Assaf and Al-Hejji, 2006; Sambasivan and Soon, 2007; Doloi et al., 2012) Effect of relationship management (Meng, 2012)	
Project complexity			External social context inducing complexity (Jaafari, 2003) Causes of project complexity (Maylor et al., 2008) Dealing with contingencies (Nystén-Haraala et al., 2010) Importance of soft skills (Azim et al., 2010) Framework for large engineering project (Bosch-Rekvelde et al., 2011) GA-based fuzzy approach to solve time–cost tradeoff problem (Leu et al., 2001) Fuzzy decision making (Lin and Chen, 2004) Fuzzy MCDM to select project proposals (Hsieh et al., 2004) New approach to mitigate risks (Flyvbjerg, 2006) Fuzzy critical chain scheduling (Long and Ohsato, 2008) Statistical methods to forecast using earned value methods (Lipke et al., 2009)
Project methods	Assessing project management maturity (Kwak and Ibbs, 2000) MCDM for selecting inter-dependent IS projects (Lee and Kim, 2001) Earned value management (Anbari, 2003) Critical chain scheduling (Herroelen et al., 2002; Raz et al., 2004; Cohen et al., 2004) Balanced scorecard for projects (Milis and Mercken, 2004) AHP as a decision making tool (Bertolini et al., 2006) Comparison of forecasting methods (Vandevoorde and Vanhoucke, 2006) Managing complexity through design structure matrices (Danilovic and Browning, 2007)	Behavioral aspects in partnering (Cheung et al., 2003) Partnering tools in construction industry (Bayliss et al., 2004) Agile methods and improvisation (Leybourne, 2009) Building information management in construction industry (Aranda-Mena et al., 2009; Bryde et al., 2013)	
Project strategy	Aligning project management with business strategy (Srivannaboon and Milosevic, 2006) Value of project management in the organization (Thomas and Mullaly, 2007)	Linkage between corporate strategy and project strategy (Jamieson and Morris, 2004) Aligning project capability with corporate strategy (Crawford et al., 2006) Use of virtual teams for value creating (Lee-Kelley and Sankey, 2008) Determinants of project strategy from project contexts (Artto et al., 2008)	

Table 2 (continued)

Theme	Deterministic	Explanatory	Non-deterministic
Project uncertainty			Sources of uncertainty (Atkinson et al., 2006) Definition of uncertainty in projects (Perminova et al., 2008) Organizing for uncertainty (Petit, 2012)
Public private partnership	Evaluation of risks for infrastructure projects (Grimsey and Lewis, 2002) Managing stakeholders in PPP projects (El-Gohary et al., 2006) Managing megaprojects (Van Marrevijk et al., 2008)	Managing relationships in PPP projects (Smyth and Edkins, 2007)	
Risk management	Strategy-based project management to manage real-time risks (Jaafari, 2001)	Construction risks in China (Zou et al., 2007) Distribution of risk responsibilities across project parties (Ng and Loosemore, 2007) Role of tools in risk management (Raz and Michael, 2001)	Managing uncertainty to address risks (Ward and Chapman, 2003) Fuzzy decision framework to model risks (Baloi and Price, 2003) Fuzzy methods for risk assessment in construction (Dikmen et al., 2007; Zeng et al., 2007) Review of risk management methods (Sanchez et al., 2009) Interdependence of risks and managerial actions (Thamhain, 2013)
Stakeholder management	Evaluation of stakeholder influence in construction industry (Olander and Landin, 2005) Trust among stakeholders (Pinto et al., 2009)	Effectiveness of tools to manage stakeholders (Bourne and Walker, 2008)	
Success factors	Critical failure factors in IS projects (Yeo, 2002) Link between success factors and success criteria (Westerveld, 2003) Model for linking success criteria and success factors (Khang and Moe, 2008)	Role of partnering (Black et al., 2000) Factors for critical project outcomes (White and Fortune, 2002) Key project practices for IS/IT industry (Hartman and Ashrafi, 2002) Critical factors for performance (Cooke-Davies, 2002) Success factors and project planning (Dvir et al., 2003) Role of human resource management in project success (Belout and Gauvreau, 2004) Importance of transformational leadership (Prabhakar, 2005) Organizational characteristics and critical success factors (Hyvari, 2006) High performing and low performing organizations (Blomquist and Müller, 2006) Definition of success in software projects (Agarwal and Rathod, 2006) Leadership competencies (Geoghegan and Dulewicz, 2008) Top management support practices (Zwikael, 2008) PM tools and project success in ID projects (Ika et al., 2010) Evolution of success factors (Muller and Jugdev, 2012)	

elements of project risk (Raz and Michael, 2001; Zou et al., 2007; Ng and Loosemore, 2007). Conceptual research is reported under the non-deterministic perspective and looks at uncertainty and risk through fuzzy or probabilistic methods. It is concerned with construct definitions of risk and uncertainty, or models to assess, measure, or manage project risk (Chapman, 2001; Ward and Chapman, 2003; Baloi and Price, 2003; Perminova et al., 2008; Sanchez et al., 2009).

Performance management is the fourth largest theme focusing on project outcomes and is almost entirely empirically grounded. Research under this theme offers measures of performance (Yazici, 2009; Ogunlana, 2010), antecedents of performance (Walker, 1995; Assaf and Al-Hejji, 2006; Sambasivan and Soon, 2007; Doloi et al., 2012; Meng, 2012) or empirical practices (Elonen and Artto, 2003; De Reyck et al., 2005; Nogeste and Walker, 2008).

From the sample, we observe that the strong decline in the influence of Project methods over the periods 2000–2005 (17 articles, EACR 202.6), 2006–2010 (15 articles, EACR 168.05), 2011–2015 (5 articles, EACR 42.8) is partially mitigated by growth in other large themes, resulting into an overall mild decline in research influence over 2000–2015.

3.2.2. Research alignment to knowledge areas

We followed Kloppenborg and Opfer (2002) to examine how the contemporary research aligns to the ten knowledge areas listed in PMBOK® guide. We observed that many sample articles addressed broader topics beyond the PMBOK® knowledge areas. To assess the alignment, we tagged each sample article with a knowledge area or a topic based on its primary research focus from a reading of the abstracts and the articles. We found that most articles addressed only one knowledge area. If an article addressed more than one area, we picked the one that connected with the research outcomes. For instance, development of Bayesian belief network model to quantify schedule risk (Luu et al., 2009) was tagged as Risk management, rather than Time as the knowledge area. After tagging the sample articles, the knowledge areas and topics were ranked by article counts as well as research influence. The rank ordering reveals further interesting insights (Table 3).

Risk management is the leading knowledge area by research output as well as influence, having 39 articles and amounting to 20% of the sample by count and by influence, followed by Time, Human resources, and Stakeholder management. We observe a mild rising trend in the Cost management area, and a

moderate decline in Time, Human resources, and Stakeholder management. The knowledge areas Procurement, Quality, and Communication are minimally represented. Scope and Integration find no representation in our sample. This comes as a surprise because several studies on success factors report variables related to these areas (Pinto and Slevin, 1988, p.71; Cooke-Davies, 2002, p.186; Zwikaël and Globerson, 2006, p. 3435; Ngai et al., 2008, p. 551; Cserháti and Szabó, 2014, p. 615).

Success factors is the leading topic of research interest, accounting for 23 articles and 15.3% of the total influence of sample articles. This indicates that empiricism continues to be favored within the research community. It is followed by Knowledge management, Portfolio management and Performance management in descending order of preference.

The influence ranking of knowledge areas and topics reveals that 60% of the research influence comes from five areas: Risk, Success factors, Knowledge management, Time, and Performance management, and shows that instrumentalism continues to characterize PM research. Four areas (Project portfolio management, Stakeholder management, Partnering, Intra-organizational processes) constitute 29% of influence showing that business strategy and interdependence themes are well engaged. Themes related to the human element (Human resources and Leadership) explain 10% of the research influence.

3.2.3. Alignment between research and the calls for research directions

Several authors have noted the atheoretic nature of the discipline and have stressed the need for greater theory-building

Table 3
Ranking of knowledge areas by research quantum and influence.

PMBOK® Knowledge area/other topic	Article counts	EACR	Major (Minor) perspective [†]	Rank by counts	Rank by influence	Trend
Risk	39	394.18	ND (E)	1	1	
Success *	23	292.51	E (D)	2	2	↑
Knowledge *	17	181.46	D (E)	3	3	↑
Time	17	172.56	E (D)	3	4	↓
Portfolio *	14	116.22	E (D)	5	6	↓
Performance *	12	117.51	E (D)	6	5	↑
Human resources	12	99.60	E (D)	6	7	↓
Stakeholder	11	99.38	E (D)	8	8	
Relationship *	9	75.21	E (D)	9	10	↓
Leadership *	8	91.39	E	10	9	↑
Organization *	7	73.06	D (E)	11	11	
Cost	5	55.63	D (E)	12	12	↑
PM maturity *	4	48.15	D (E)	13	13	
External *	4	38.55	E (ND)	13	14	↓
Procurement	2	18.21	E	15	16	↓
PPP *	2	18.67	D	15	15	
Communication	1	8.75	D	17	17	
Quality	1	7.00	D	17	18	↓
PMO *	1	6.89	D	17	19	↓
Scope	0	0.00		20	20	
Integration	0	0.00		20	20	
Total **	189	1914.91				

Boldface indicates most favored areas or topics within the research community.

* Topics other than PMBOK® Knowledge areas.

** Articles related to research methods, meta-studies, or research directions excluded.

[†] D: Deterministic; E: Explanatory; ND: Non-deterministic.

effort. A review of 21 papers⁷ from our sample reveals three major prescriptions for research directions:

1. Paradigmatic or methodological prescriptions include conceptualization of projects as multi-objects in open systems (Winter et al., 2006b); developing normative models to reflect current best practice e.g. critical chain (Maylor, 2001); adopting soft paradigm (Pollack, 2007); Situating research correctly within paradigms (Smyth and Morris, 2007); and Blending alternate approaches such as PMBOK® and Agile methods (Williams, 2005).
2. Calls for several alternate perspectives such as Complexity in projects (Shenhar and Dvir, 1996; Williams, 1999, 2005; Shenhar, 2001; Pich et al., 2002; Winter et al., 2006b; Cicmil et al., 2006; Artto and Kujala, 2008; Whitty and Maylor, 2009); Organizational or human characteristics and interactions (Maylor, 2001; Söderlund, 2004a; Winter et al., 2006a,b; Cooke-Davies et al., 2007; Shenhar and Dvir, 2007; Whitty and Maylor, 2009); Knowledge, skills and learning (Maylor, 2001; Cicmil et al., 2006; Sauer and Reich, 2009); Social contexts and agendas (Söderlund, 2004a; Sauer and Reich, 2009; Morris, 2010); and Integration (Maylor, 2001; Shenhar and Dvir, 2007; Blomquist et al., 2010).
3. These authors also suggest focus on research outcomes that include grounding of variables, factors, and measures; and suggest development of models, typologies and frameworks towards theory-building.

Contrasting the other sample articles against the above prescriptions shows a relatively low level of alignment to calls for change. Only 18% of the sample (38 articles) referenced any of the 21 papers on the research directions, showing that PM research remains broadly anchored in the traditional paradigms and methodologies.

4. Discussion of results

This paper employs a two-part systematic review of PM literature to examine motivations, themes, and trends in PM research. We find that PM research is characterized by broad perspectives of determinism, empiricism, and non-determinism; evolving as three distinct perspectival eras: Deterministic, Explanatory, and Non-deterministic running contemporaneously over 2000–2015. The second part of the review shows a growing trend in research output; and a steady decline in research influence over 2006–2015 for all three perspectives, suggesting maturation of existing themes and a possible non-occurrence of new themes.

Examination of thematic progression over three sub-periods: 2000–2005, 2006–2010, and 2011–2015 shows Project methods, Success factors, Risk management, Performance management, and Knowledge management to be the leading themes based on the research quantum. From an alignment of the chosen articles to PMBOK® knowledge areas and other topics we find that Risk, Success factors, Knowledge management,

Time, and Performance management explain 60% of the research influence, reinforcing the instrumental nature of PM research.

We also find that empiricism and determinism dominate the research output over 2000–2015. However the latter shows sustained decline in both quantum and influence. While themes under explanatory perspective appear to enjoy healthy subscription and offer rich outcomes, they are unlikely to build parsimonious theories, or point to strong future directions. We note that several topical themes such as Performance, Risk, Governance & control, Project complexity or uncertainty, and organizational factors involve a high degree of interdependence, intractable or unknown variables, and human cognitive factors. We argue that these are less amenable to determinism or empiricism, and are better served by adopting a non-deterministic perspective and corresponding methodologies. Given the low and sporadic nature of non-deterministic research and weak alignment to the calls for alternate research directions discussed in Section 3.2.3, it may be appropriate to heed the calls towards renewed focus on non-determinism and theory building in PM. Our study offers insights for several avenues for future research. A few are illustrated below:

- Scheduling was the dominant theme in the deterministic era. It has maintained its deterministic OR orientation, and has been declining in output as well as influence. Further, its primary focus remains limited to planning processes, e.g. PMBOK® Edn V (Project Management Institute, 2013) devotes nearly 40 pages to schedule planning and only 4 pages for controlling it. However, time is fundamentally non-deterministic, as it is an outcome of interacting processes and human actors in project contexts. While recent research examines intra or inter-organization processes, knowledge and social contexts, it does not examine their linkages to time outcomes. For instance, activity estimates are based on work rates, but we know very little about them under the various conditions information availability, scope ambiguity, and social contexts. Attempts to model time variability through methods such as PERT based on beta distribution remain approximate at best, since no theoretic basis exists to support any probability distribution (Trietsch et al., 2012). We argue that research needs to adopt non-deterministic perspective to examine scheduling and go beyond planning processes because of the systemic interconnections of time within the project phenomena. Efforts focusing on processes and contexts to the exclusion of time variables are unlikely to converge to theories.
- Knowledge management is interconnected with organizational processes and human characteristics. We find a strong empirical research orientation for Human resources, while deterministic perspectives dominate for the other two (Table 3), thus pointing to an opportunity for an integrative research across the three areas.
- Research attention on several PMBOK® knowledge areas such as Quality, Scope, Integration, is minimal. This is surprising since these areas are often featured in studies on success or failure factors. For instance, scope creep is commonly listed as one of the causes of failure (Nelson, 2007, p. 74), and thus warrants further investigation into workings of the phenomena.

⁷ Indicated in the bibliography with an asterisk.

- Knowledge has a strong linkage to Communication practices, and both are key principles of agile methods (Manifesto, 2001). We find that PM research has a minimal focus on Communication. How communication practices contribute to acquisition and assimilation of knowledge in project contexts could be a productive line of enquiry.
- Risk management is the leading area of research interest and is dominated by the non-determinism with a fair share of empiricism. However, its sporadic nature suggests that it does not see consistent engagement. We note that complexity and uncertainty are the main lenses of enquiry in PM literature, and that these lenses are not distinct in terms of definitions or constituent terms (Williams, 1999; Maylor et al., 2008; Perminova et al. 2008; McLain, 2009; Geraldini et al., 2011; Brady and Davies, 2014; Ramasesh and Browning, 2014). Such conflation along with the plurality of research methods (Sanchez et al., 2009) under the two lenses may explain the sporadic and non-convergent nature of research on risk management. Further work on obtaining perspectival and methodological convergence and grounding the taxonomies should prove to be promising.
- The mix of non-determinism and empiricism in Risk management (Table 3), suggests an opportunity to build synthesizing frameworks to integrate the empirical and conceptual research on project risk. For instance, the work by Thambain (2013) together with Turner and Zolin (2012) could possibly offer further research avenues.

5. Conclusion

Project management literature is characterized by a rich tradition of multiple paradigms, perspectives, methodologies and streams of enquiry, and weak theories. There are very few studies that aggregate the diverse research streams into meaningful themes and to inform on further research directions. This study attempts to fill this gap through a systematic review of thematic evolution and trends in literature. The main research direction emerging from our study is that theory building in project management requires adoption of the non-deterministic perspective, i.e. addressing the variability in project phenomena, and employing the appropriate theoretic and methodological approaches. We argue that continued adherence to determinism or empiricism without a schema for aggregation, convergence, and generalizability of outcomes. The non-deterministic perspective could support new lines of enquiry capable of offering more insightful results.

We acknowledge several limitations of this study. First, our study builds an evolutionary view from a set of meta-narratives. As this view is grounded in historiography, it requires parsing a large amount of historical information and condensing it into small datasets. It therefore has a dependency on the methodology employed for study. We believe our sample of 36 studies is sufficiently robust to support the elicited inferences. Second, our thematic analysis is based on well-cited articles from project-focused journals. This is based on the assumption that major themes and their trends would be associated with high cross-sectional as well as longitudinal influence; and would

tend to be hosted in project-focused outlets. We believe that the probability of a major theme or trend negating this assumption to be quite small. Third, we propose a measure of influence that accounts for the longitudinal effect on research influence. Such a formulation is novel to our knowledge, and has been rarely tried in the literature. Alternate measures of research influence could exist, and may impart different information on the state of research. Despite the above limitations, we believe our study offers useful insights to present and future researchers.

Appendix 1. List of reviews for part 1

	Article	Journal	Search strategy	No. of articles ^a	Study period
1	Willis (1985)	European Journal of Operational Research	Keyword	24	1967–1982
2	Icmeli et al. (1993)	International Journal of Operations and Production Management	Keyword	56	1966–1991
3	Kolisch (1996)	European Journal of Operational Research	Snowball	63	1959–1995
4	Herroelen et al. (1998)	Computers and Operations Research	Snowball	118	1959–1998
5	Brucker et al. (1999)	European Journal of Operational Research	Snowball	203	1959–1998
6	Kolisch and Padman (2001)	Omega	Snowball	–	1959–2000
7	Kloppenborg and Opfer (2002)	Project Management Journal	Snowball	3554	1960–1999
8	Tesch et al. (2003)	Project Management Journal	Snowball	784	1999–2001
9	Herroelen and Leus (2004)	International Journal of Production Research	Snowball	58	1964–2003
10	Söderlund (2004a,b)	International Journal of Project Management	Keyword	–	1993–2002
11	Herroelen and Leus (2005)	European Journal of Operational Research	Snowball	–	1974–2004
12	Herroelen (2005)	Production & Operations Management	Snowball	131	1966–2005
13	Jugdev and Müller (2005)	Project Management Journal	Snowball	69	1985–2005
14	Turner and Müller (2005)	Project Management Journal	Snowball	–	1955–2005
15	Rozenes et al. (2006)	Project Management Journal	Keyword	96	1987–2005
16	Crawford et al. (2006)	International Journal of Project Management	Snowball	7	1994–2003
17	Aloini et al. (2007)	Information and Management	Keyword	75	1999–2005
18	Huemann et al. (2007)	International Journal of Project Management	Keyword	79	1978–2006
19	Carden and Egan (2008)	Project Management Journal	Snowball	90	1968–2004
20	Ngai et al. (2008)	Computers in Industry	Keyword	48	2006–2007

Appendix 1 (continued)

Article	Journal	Search strategy	No. of articles ^a	Study period
21 Arto et al. (2009)	International Journal of Project Management	Snowball	1164	1986–2006
22 Ika (2009)	Project Management Journal	Keyword	30	1986–2004
23 Kwak and Anbari (2009)	International Journal of Project Management	Snowball	537	1950–2007
24 Hartmann and Briskorn (2010)	European Journal of Operational Research	Snowball	–	1964–2009
25 Littau et al. (2010)	Project Management Journal	Keyword	116	1984–2009
26 Geraldi et al. (2011)	International Journal of Operations and Production Management	Keyword	25	1996–2010
27 Biedenbach and Müller (2011)	International Journal of Managing Projects in Business	Snowball	116	1994–2007
28 Weglarz et al. (2011)	European Journal of Operational Research	Keyword	218	1959–2010
29 Zhang (2011)	Project Management Journal	Keyword	171	1999–2009
30 Müller and Jugdev (2012)	International Journal of Managing Projects in Business	Keyword	15	1988–2011
31 Savolainen et al. (2012)	International Journal of Project Management	Keyword	7	2003–2009
32 Müller et al. (2014)	International Journal of Project Management	Keyword	42	1999–2013
33 Pollack and Adler (2015)	International Journal of Project Management	Keyword	94,472	1962–2012
34 Svejvig and Andersen (2015)	International Journal of Project Management	Keyword	74	1995–2012
35 Hazir (2015)	International Journal of Project Management	Keyword	–	1984–2014
36 Laursen and Svejvig (2016)	International Journal of Project Management	Keyword	111	1994–2014

Complete bibliography with authors.

^a For narrative reviews, the counts of papers and study duration were taken from the bibliographies.

Appendix 2. Coding structure for literature review

The following information was collected/coded for each article based on its abstracts and/or contents:

1. *Year*: Year of publication
2. *Title, Authors, Journal, Citation counts, Abstract and keywords*⁸
3. *Thematic perspective*: The article was tagged as Deterministic if it proposed models or frameworks based on theories; As

explanatory if its research outcomes were inductively derived or statistically inferred from data; As Non-deterministic if it addressed the phenomena through lenses of complexity or uncertainty; and as General theme if it presented meta-studies or discussed research directions.

4. *Knowledge area*: Ten areas from PMBOK® 5th Edition (Project Management Institute, 2013): *Integration, Scope, Time, Cost, Quality, Human resources, Risk, Communication, Procurement, and Stakeholder*; Eleven topics inductively identified from reading the article title, abstract and browsing the main body of the article: *Knowledge, Leadership, External to project context (EXT), Intra-organizational (Org), Performance management (Perf), Project management maturity (PM maturity), Program management office (PMO), Program or portfolio management (Portfolio), Public private partnership (PPP), Partnering and relationship within the project or program context (Relationship), and Success/failure factors or criteria (Success)*.
5. *Theme*: The research theme of the article was inductively derived based on the research objectives stated in the abstracts or the main body of the article. (Table 1 for the list of major themes)
6. *Research question*: Taken from the article title or abstract.

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⁸ Citation information extracted on 29–31 January 2016

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