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Is there only one way of project management theorizing, or are there multiple sector-specific project management domains?

Abstract

Purpose: Many literature reviews on project management (PM) research are limited to studies published only in PM journals but some reviews do expand their analysis on PM research published also in journals belonging to the management studies field. However, we found no previous literature reviews comparing the PM content in different sectors outside the management studies field. Therefore, our analysis and findings of PM content derived from the sector-specific engineering and technology-focused journals are new.
Design/methodology/approach: We analyze PM content in nine different sectors, where each sector and its inherent research is connected to specific engineering, technological, or industry-related disciplines. We conduct an evidence-informed literature review on project management knowledge in the distinct literatures of these nine sectors. The period of analysis is 24 years from 1986-2009. We discuss potential consequences of our findings' sector-specificity for future PM domain development.
Findings: Our perspective on different origins of PM leads to a meta-level PM concept covering several different PM domains, each with its own sector-specific and separated development path.
Research limitations: Our literature analysis purposefully excluded PM journals and management studies, and we focused only on sector-specific engineering and technology-focused journals that represent knowledge and wisdom of different PM contents in nine sectors.
Research/Practice implications: The findings have significant potential to contribute to scholarly discussion on the development of a universal project management theory. For applicability across sectors, we suggest a modular PM theory with different sector-specific modules for knowledge, concepts, and underlying assumptions.
Originality/value: Currently, this discussion has been mainly focused on theorizing concepts and approaches in management studies only. This study expands our understanding to engineering and technology-focused journals across nine industry sectors/domains.

Keywords: Project management; sectors; industries; engineering disciplines; project management domains; modular project management theory.

1. Introduction

Our understanding of what project management (PM) is may be perceived differently depending on the industry sector or engineering discipline in which it is applied. In this paper, we address this problem of different PM domains by reviewing PM perspectives from different sectors. We argue that understanding the sector-specificity in PM contents makes a valuable contribution to developing a broad theory of PM. We use the term sector to refer to a technology-focused sector that is connected to a specific engineering, technological, or industry-related discipline. Therefore, a specific sector addresses specific needs and markets, and has developed its own practices. We expect that these practices differ not only with respect

to the engineering practices, but also to the management practices, including project management practices.

We selected nine different sectors to analyze, where a sector and its inherent research is connected to a specific engineering, technological, or industry-related discipline. The nine sectors are: engineering (Eng); construction (Con); software and IT (Sof); healthcare (Hea); chemical systems (Che); power and energy (Pow); environment (Env); biotechnology and pharmaceutical (Bio), and; space and aerospace (Spa). We describe the selection of the sectors in detail in the method section. We analyze the PM content in these nine different technology-focused sectors but we exclude central PM journal (i.e., IJPM, PMJ, and IJMPiB) articles from our analysis. Furthermore, we also exclude the management studies from our in-depth analysis. Despite this exclusion, we have included 'general management' (Gen) journals as an extra "tenth sector" in our paper for comparison purposes to serve as a reference sector for the actual analysis of the nine technology-focused sectors.

Previous research has focused on content analysis of PM journals relating to re-thinking PM for example in PM journals (Svejvig and Andersen, 2015; Walker and Lloyd-Walker, 2016), and there are few recent studies (Artto et al., 2009; Kwak and Anbari, 2009; and Söderlund, 2002, 2011) that widen the understanding about the PM research basis to management studies outside the dedicated PM journals. However, there is no previous research that would expand the research basis of theorizing on PM to different technology-focused and engineering sectors and domains outside the management studies. Therefore, our research on sector-specific PM through an analysis on articles connected to engineering journals of the software, construction, and other major technology-focused sectors is novel.

The research questions (RQs) addressed are:

RQ1: What are the specific PM content in different sectors?

RQ2: What are the similarities and differences in the PM content across sectors?

RQ3: Why is PM understood differently in different sectors, and what are the potential consequences of sector-specificity for developing the PM domain in the future?

The adopted research approach is based on an evidence-informed review approach (Tranfield et al., 2003) with an adaptation of meta-ethnography (Barnett-Page and Thomas, 2009) This is an effective method for creating a synthesis of the collective wisdom from existing research for synthesizing appropriate management knowledge instead of always conducting new empirical research for developing new knowledge. Relevant research including the collective wisdom in each sector is found in sector specific journals, so we connected journals from ISI Web of Science to each of the nine sectors according to their overall content being dedicated to the specific sector. The method section introduces the research approach, describes the selection of the nine sectors, the choice of the 24-year period 1986-2009 of analyzed publications, quality evaluation for the inclusion and exclusion criteria of articles into the analysis, and the analysis process. Section 4 addresses RQ1 by presenting the analysis of PM content in each of the nine sectors, and Section 5 addresses RQ2 by analyzing the similarities and differences between sectors. During the analysis, we derived seven key areas that we used in structuring the analysis of the PM content by sector: we looked at each sector through using these seven areas as a lens to component parts of the PM content in each sector. Structuring into seven distinct areas helped us discern

similarities and differences across each sectors, for example observing 'no dominant focus' in some key area in a specific sector or as a contrast to other sectors where PM might be focused in that specific key area. We also consider that this seven key areas structure can be used for developing universal or cross-sector PM knowledge.

In the contributions section we discuss the three specific PM research contributions that this study makes: First, our research exposes the existing PM sector-specificity through introducing different PM content in sectors. This sector-specific content can be considered as distinct sector-specific domains in their own right. Second, in the contributions section, we suggest explanations about differences between sectors, which serve as explanations to the question why PM is different in different sectors. Third, the findings contribute both to the development of multiple PM theories and, if appropriate, one universal PM theory. Multiple different PM theories can be derived from the domains of different sectors, each theory being based on the distinct literature course of a specific sector. Each of the sector-specific discourses are based on different underlying assumptions, constructs, definitions, and logics, and therefore different theorizing can be derived thereof. In addition, the understanding of the similarities and differences across sectors can be used for the development of a universal PM theory that is applicable across multiple sectors – perhaps a modular PM theory where different sectors would use different modular management knowledge. The discussion of the development of such universal theory has been focused so far mostly in theorizing on the concepts and approaches in management studies only, and not in studies in different technology-focused or engineering sectors. Finally, in the further research section, we suggest several avenues for future research.

2. Previous research on project management theorizing

PM has been previously theorized in articles in such central PM journals and other dedicated PM publications that are now excluded in our actual evidence-informed analysis of literature. In this section, however, for an overview to an interested reader about several previous attempts to address PM theory, we cite briefly to these articles in PM journals dedicated PM publications that are excluded in our actual analysis on sectors. Readers interested in content analysis of PM journals relating to re-thinking PM for example in PM journals are referred to Svejvig and Andersen (2015), and Walker and Lloyd-Walker (2016).

There have been several attempts to address PM theory. Turner's (2006a, b, c, d) series of IJPM editorials address the various postulates of what PM is. Morris asks in his recent book (Morris, 2013): "… is PM a discipline or a domain …" and continues with an answer: "… obviously, both. …". Söderlund (2002; 2011) suggested seven schools of thought in PM research. Bredillet (2007a; 2007b; 2007c; 2008b; 2008a; 2010) also explored schools of thought research in PM from the perspective of nine schools of thought by using analogy that follows Mintzberg's (1979) schools of thought in strategy. Turner et al. (2010) describe nine different views on projects in their 'Perspectives on Projects' book. Artto and Kujala (2008) argue that several theories can be selected to address projects, their management, and related phenomena. Morris (1994, 2010) provides a historical overview of PM and its theoretical and practical foundations from the ancient time of building large structures (such as the Pyramids or Roman roads) with a more detailed analysis since the emergence of modern project and program management in the 1950s and 1960s. The recent book by Morris (2013) on 'Reconstructing Project Management' suggests a way forward in PM theory development by including sponsor value and benefits within the organizational setting of projects, among many other issues. He analyzes and suggests the future developments of PM

both as a scientific cross-disciplinary research domain, and as a discipline or a practical area of application. Smyth and Morris (2007), and Biedenbach and Müller (2009) provide an analysis of methodological research approaches in PM research. Winter and Szczepanek (2009) made a new contribution to understanding PM work through their metaphorical perspectives on PM as: social image of projects; political image of projects; intervention image of projects; value creation image of projects; development image of projects; organizational image of projects; and change image of projects.

PM may be considered to refer to a narrow knowledge foundation developed during the 1950s and 1960s among dedicated PM researchers in a specific trajectory emerging from modern project and program management ideas. Another form of a narrow interpretation of PM is the adoption of a specific practice-oriented focus on the management of a single project, mainly focused on following contemporary PM standard documents, including ISO, 2012; PMI, 2013; IPMA, 2006; and APM, 2012. The popularity of these standard documents can be explained by the fact that they include normative-oriented representations of knowledge areas (or processes) useful for PM practitioners and for company users (Morris et al., 2006). Such practice-oriented perspectives have a real impact on perceived PM content.

Many PM books (such as e.g. Turner 1999; 2007; 2009) acknowledge shortcomings in current PM theory and attempts for its development. Indeed, there are different interpretations on the content of projects and their management, which are each based on different paradigms and theoretical foundations. In their 'theory of temporary organizations' paper, Lundin and Söderholm (1995) take an organizational perspective of PM and see PM as a temporary organization established to undertake a set of tasks, over a defined time that follows a project cycle from birth to institutional termination using a team of people to enact a transition of some kind. These tasks or transformations may be repetitive (such as building an estate of dwellings) or highly innovative (such as flying to the moon for the first time). More recently, Lundin and Söderholm (2013) reflect on their paper on the theory of temporary organizations published in 1995, commenting on it as being 'a child of its time and in need of reconsideration and reconstruction'. In their 2013 paper, they now introduce the concept of 'end state' being a potential path forwards in the development of new theories of temporary organizations. Andersen's (2008) book 'Rethinking Project Management' provides an organizational perspective on projects. He argues that PM undertaken within a base organization by project teams, e.g. business process change programs, may and often do, have different time, scope and benefit expectations than projects such as construction, ship building or aerospace where project teams are established to deliver a tangible artifact. Therefore, Andersen (2008) provides an alternative organizational perspective of PM to that of many established PM books. The research networks for "rethinking project management" (Winter et al., 2006) and "critical project research" (Hodgson and Cicmil, 2006a, b; Clegg et al., 2006) challenge traditional views of projects and their management (for more details refer to papers presented in the 2016, Volume 9, Issue 4, International Journal of Managing Projects in Business). Artto and Kujala (2008) argue that a project can be an independent business organization, with management of: business through projects; networks of actors engaged on a project; or autonomous business scheme that crosses – or even redefines – the organizational boundaries of formally/organizationally defined projects, firms and/or other actors.

In conclusion, we argue that surprisingly many PM studies assume that PM research is published only in PM mainstream journals, i.e. IJPM, PMJ, and IJMPiB, or conferences or tracks, or books dedicated specifically to the PM theme. We consider this a rather limited view, as we assume that PM theory is also advanced through researching projects and their management in publications of other disciplines and sectors. The existing research outside PM has focused on management studies only (Artto et al., 2009;

Kwak and Anbari, 2008, 2009; and Söderlund, 2011) and not in the research in technology-focused or engineering sectors. Consequently, we conclude that although PM represents an area cutting across various sectors, PM research with its sector-specific research articles is often ignored when considering the fuller representation of PM research. We argue that such ignorance may considerably narrow our PM content perspective, by ignoring which forms PM takes in various sectors. We address this gap by focusing this paper to serve as a vanguard effort to investigate PM literature more widely, i.e. by investigating PM content specifically in technology-focused sectors by increasing our understanding of which forms PM takes when looked through the existing sector specific research content.

3. Method

3.1 Research approach

This research develops original sector specific knowledge for understanding PM sector-specificity in selected technology-focused sectors. We develop evidence-informed management knowledge through a systematic literature review (Tranfield et al., 2003; Barnett-Page and Thomas, 2009), by using methodologically similar evidence-informed reviews on other themes and in other fields (e.g. Dybå and Dingsøyr, 2008, on agile software development; and Birnik and Bowman, 2007, on marketing mix standardization) for methodological guidance in designing the detailed analysis of this study. Tranfield et al. (2003) developed management knowledge through this kind of review arguing that "Undertaking a review of the literature to provide the best evidence for informing policy and practice in any discipline, is a key research objective for the respective academic and practitioner communities." Denyer and Tranfield (2005) suggest that synthesis of the collective wisdom from existing research through systematic literature reviews is an effective method for developing technological rules. Therefore literature reviews should be favored over conducting new empirical studies. This paper's analysis can be labeled as a 'realist synthesis' (Denyer et al., 2008) with an adaptation of a meta-ethnographic literature review (Dybå and Dingsøyr, 2008; Barnett-Page and Thomas, 2009). This research approach is devised as a synthesis that proposes the content of PM in different sectors. Content proposed at a detailed analysis level explains PM nuances in specific sectors and we also propose PM meta-level content from the seven key areas derived from our analysis. In other words, introducing these seven key areas – i.e., modeling; management control; contingency view; innovation and development; open system view; network management, and; people-focused approach – can be considered as a suggestion of a high-level structure of PM content. This structure can be used in the development of an universal theory of PM, or this structure can be used to explain the cross-sector differences of PM applications by using our findings of different emphasis in each key area by the sector (from no dominant focus to specific meaningful content in the key area, see Table 3).

3.2. Selection of the nine sectors and their representative journals

We selected sectors for this study using the following two criteria. First, one part of the selected sectors were recognized in systematical historical reviews to have adopted and developed PM as a theoretical or practical field (Morris 1994, 2010). These sectors certainly historically relate to early origins of the PM discipline: construction (Con), power and energy (Pow), chemical systems, oil and gas (Che), general engineering disciplines (Eng), and space, aerospace and aircraft (Spa). Second, other selected sectors were from known to have emerged or grown more recently, and developed and matured in terms of their managerial and other approaches. We therefore consider these sectors as more contemporary sectors and

used their connection to projects and PM as a selection criterion. In evaluating the adoption of PM in these sectors we evaluated the emphasis of the PM in these sectors by looking at both the number of existing sector specific journals and their PM representativeness as a theme in the journal articles. These more contemporary sectors include: software and information technology (Sof), healthcare (Hea), biotechnology and pharmaceutical (Bio), and environment and sustainability (Env). Despite excluding management studies from our analysis, we have included 'general management' (Gen) journals as an extra area (or "tenth sector") for comparison purposes and to serve as a reference sector for the actual analysis of the nine technology-focused sectors. The nine sectors (and Gen as an extra tenth area) selected for this study are:

1. Eng - Engineering (general engineering disciplines excluding Con, Sof, Che, Env, Spa)
2. Con - Construction, building, and civil engineering
3. Sof - Software and IT, telecom, and computers (including hardware and software)
4. Hea - Healthcare
5. Che - Chemical systems, chemical engineering, and oil and gas
6. Pow - Power and energy, energy production, and energy systems
7. Env - Environment and sustainability
8. Bio - Biotechnology and pharmaceutical
9. Spa - Space and aerospace, aircraft engineering
10. Gen - General management (an extra tenth area, or "tenth sector", for comparison)

We formed the sector specific ISI Web of Science journal pool by placing individual journals into appropriate sectors, matching compliance of ISI Web of Science's subject area categories of individual journals to the nine sectors. In categorizing the journals into sectors, we also evaluated each journal's profile in terms of its name and statements of its editorial focus areas. During the analysis phase we considered the appropriate fit of each journal within the positioned sector by recognizing the potential validity issues that may relate to an individual journal's content coverage over several sectors. We found that positioning journals into the nine sectors occurred rather naturally with no controversial issues raised in our positioning decisions concerning its focus, thematic profiling and its overall editorial policy for any whole journal. Through this procedure, we pooled altogether 3,201 journal and conference proceedings articles in the ISI Web of Science database to the nine sectors and the Gen area (see Table 1).

3.3. Selection of PM articles in sectors

We selected articles available in ISI Web of Science published during 1986-2009 to serve as the initial database. Technological and organizational changes in society occur slowly and gradually over several decades, and we can consider that this 24-year period of 1986-2009 is long enough to be insensitive to variations in shorter periods of time that may be affected by management or other fads, e.g., local developmental trends over recent years. Access to the full ISI Web of Science data for this specific time period supported the selection of articles in this period by searching using the word 'project management' (in the publication title, abstract or list of keywords). We call these articles (found by using the search word 'project management') as 'PM articles', irrespective of the publication being a journal article or a conference paper. The search among the 3,201 journals over the 24-year period produced a varying number of PM articles in the nine sectors plus the Gen area (Table 1): we found 2,354 PM articles in 564 journals.

Table 1 allows us to explore the 'external' or 'outside' territories to previous research on project management theorizing, to look at the number of PM articles by sector discover which sectors PM is researched and the extent to which it is or is not researched. For example, the largest number of PM articles in the Sof sector (software and IT, telecom, and computers) in Table 1 provides an interesting and even somewhat surprising observation: 744 PM articles in Sof in 143 journals overcomes all other sectors – and even Gen – in article and journal amounts. This might be an indication that Sof sector has a PM domain that is vividly developed and maintained in the literature that is specific to Sof sector. The smallest numbers can be found in Spa sector (space and aerospace, and aircraft engineering) with 14 journals and 29 PM articles.

Table 1. Number of project management articles and journals by sector

Sector	Eng	Con	Sof	Hea	Che	Pow	Env	Bio	Spa	Gen	TOTAL
Number of journals within the sector	559	112	366	219	314	25	337	819	69	381	3,201
Number of journals which included project management articles	116	36	143	47	29	12	42	20	14	105	564
Number of project management articles	445	380	744	74	57	23	60	52	29	490	2,354

Table 2 provides the names of the top-10 journals by sector, ranked by the largest number of PM articles (Counts, C) of those sector-specific journals including project management articles (which were indicated in Table 1 only by journal numbers and not names). Table 2 content is significant for treating PM as a cross-sector research domain: the journal-specific publication counts for their PM articles provides a more detailed understanding of the 'external' or 'outside' territories through deepening the understanding of what are the journals/outlets where different sectors publish articles about PM.

Table 2. Top-10 journals in the 9 industry sectors and Gen, with the largest number (or count, C) of project management articles, by descending order of counts by sector

	ENG	C	CON	C	SOF	C	HEA	C	CHE	C	POW	C	ENV	C	BIO	C	SPA	C	GEN	C
1	IEEE Transactions on Engineering Management	67	Journal of Construction Engineering and Management	143	Lecture Notes in Computer Science (LNCS)	76	International Journal of Medical Informatics	7	Computers & Chemical Engineering	8	ATW - International Journal for Nuclear Power	6	Water Science and Technology	6	Drug Information Journal	21	Acta Astronautica	10	*European Journal of* Operational Research	113
2	Technovation	26	Automation in Construction	32	Information and Software Technology	46	Journal of the American Medical Informatics Association	4	Chemical Engineering Progress	4	Fusion Engineering and Design	3	Building and Environment	5	Social Science & Medicine	3	Space Communications	3	Journal of the Operational Research Society	49
3	International Journal of Production Economics	20	Canadian Journal of Civil Engineering	22	Journal of Systems and Software	40	CIN Computer Informatics Nursing	4	Oil & Gas Journal	4	Nuclear Energy-journal of The British Nuclear Energy Society	2	Climate Policy	3	American Journal of Pharmaceutical Education	3	Aircraft Engineering and Aerospace Technology	3	Management Science	31
4	International Journal of Technology Management	19	Journal of Computing in Civil Engineering	16	Information & Management	36	Risk Analysis	4	Chemical Engineering	3	Journal of Nuclear Science and Technology	2	Energy Policy	3	Journal of Digital Imaging	3	Space Policy	2	Omega International Journal of Management Science	22
5	Journal of Professional Issues in Engineering Education and Practice	16	Building Research & Information	16	Industrial Management & Data Systems	25	Methods of Information in Medicine	3	Accreditation and Quality Assurance	3	Fusion Science and Technology	2	Habitat International	2	Biopharm International	3	ESA Bulletin-European Space Agency	2	R & D Management	20
6	International Journal of Production Research	15	Proceedings of the Institution of Civil Engineers – Civil Engineering	15	IEEE Transactions on Software Engineering	25	American journal of physical medicine & rehabilitation	2	Chemical Processing	3	ATW Internationale Zeitschrift fur Kernenergie	2	Environmental Management	2	**Biopharm - the Applied Technologies of Biopharmaceutical Development**	3	Proceedings of the Institution of Mechanical Engineers, Part G: Journal of Aerospace Engineering	1	International Journal of Operations and Production Management	17
7	The International Journal of Advanced Manufacturing Technology	12	Civil Engineering	9	IEEE Software	19	Australian Health Review	2	Chemometrics and Intelligent Laboratory Systems	2	Nuclear Plant Journal	1	Journal of Hazardous Materials	2	Computer Methods and Programs in Biomedicine	2	Nouvelle revue aéronautique astronautique	1	Interfaces	10
8	Journal of Product Innovation Management	11	Proceedings of the Institution of Civil Engineers - Municipal Engineer	8	Expert Systems with Applications	17	Health Promotion International	2	Chimia	2	Nuclear Instruments and Methods in Physics Research Section A	1	Environmental Progress	2	Acta Crystallographica Section D: Biological Crystallography	2	JBIS: Journal of the British Interplanetary Society	1	Journal of Operations Management	9
9	Production Planning & Control	11	Transportation Research Record: Journal of the Transportation Research Board	6	Computers & Industrial Engineering	17	Health Services Research	2	Neftyanoe Khozyaistvo - Oil Industry	2	Nuclear Engineering International	1	Journal of Soil and Water Conservation	2	American Journal of Health-System Pharmacy	1	Journal of Spacecraft Technology	1	Annals of Operations Research	9
10	IIE Solutions	11	Computer-Aided Civil and Infrastructure Engineering	6	Software Quality Journal	16	The International Journal of Health Planning and Management	2	Energy Engineering	2	Journal of Radioanalytical and Nuclear Chemistry	1	Environmental Modelling and Software	1	Artificial Intelligence in Medicine	1	Journal of Aerospace Engineering	1	System Dynamics Review	8

3.4. Analysis process and reporting

We analyzed all PM articles (except 293 that were not accessible, for example due to manual volume in a distant location or due to proprietary status) by first reading their abstracts (i.e., we read the abstracts of 2,354 [see Table 1] minus 293 = 2,061 articles). When reading the abstracts, we evaluated the quality of the articles in terms of their rigor, credibility, and relevance (analogously to the Dybå and Dingsøyr, 2008 evidence-informed review) for their inclusion or exclusion for further analysis. Rigor, credibility, and relevance were evident from answers to questions - Rigor: Has an appropriate approach/method been applied to treat the data for justified results, i.e. is this a research paper (not merely a lessons learned report on expert opinion)? Credibility: Are the analysis, observations and findings well-presented and meaningful? Relevance: Are the analysis, observations and/or findings connected to the knowledge on the management of projects area? Our analysis focused on key contributions, the main problem statement and core research content of each article. We made notes while reading and recorded the content descriptions and our evaluations on the quality of the articles onto a spreadsheet. We read the articles, including its evaluated quality, for the synthesis of the actual PM content in each sector. The reading was an iterative process, and we continued making notes by recording content descriptions of the articles and central observations and interpretations thereof. In this way we also iteratively read and re-read the articles further developing our understanding of their quality. We wrote several reports of each sector and their articles, to support our analysis. Furthermore, to facilitate the analysis process, we made charts, diagrams and tables that helped us to understand the sector-specific PM domains and their similarities and differences while appreciating their fundamental assumptions, requirements set by the sector, and potential institutional issues underlying these domains. For example, when analyzing the significance of an article for the sector and its domain, we produced reports that showed the number of citations received by the article from other articles from the same sector.

We followed meta-ethnography procedures when reading articles by determining how the studies are related by translating the studies into one another. To facilitate this, we tabulated the PM content in articles, and we noted whenever articles were referring to similar or different PM content and patterns between articles. This process was iterative: whenever we recognized a new issue concerning the characteristics of the management of a project, we returned to other articles and compared this new issue to prior observations. We derived a structure of seven key PM areas from our analysis: modeling; management control; contingency view; innovation and development; open system view; network management, and; people-focused approach. We used these seven key areas as the basis for our analysis to compare sectors, but we also consider this seven key areas structure facilitates development of a universal PM theory. It might also explain cross-sector differences through indicating which key areas are emphasized in a specific sector, and which key areas may be even lacking in the PM domain of a specific sector.

4. The specific PM content in different sectors

This section addresses RQ1 (“What are the specific PM content in different sectors?”) by reporting PM content for each of the nine sectors based on our evidence-informed review of sector specific literatures. In this section, we have included citations to all PM articles that were filtered through using the quality criteria, to provide the reader with understanding of what the actual sector-specific project management

articles are. However, on the other hand, for the purpose of not confusing the reader with 'other' sources, we have only cited these articles that have been filtered to be included in our analysis through using the quality criteria (i.e., this section does not include citations to 'other' sources than those of this evidence-informed review).

Gen - General management

The extensive number of articles on scheduling in Gen sector have roots in the critical path method (CPM) and program evaluation and review technique (PERT) developed in the late 1950s and early 1960s. They address scheduling and related resource allocation, financial aspects including time/cost tradeoff issues, risk and criticality, multi-criteria optimization, and appropriate algorithms and heuristics for these, mostly through introducing computational applications based on mathematical algorithms and heuristics as a solution for improving different aspects of resource-constrained PM (Demeulemeester and Herroelen, 1992; Herroelen et al., 1997; Williams, 1992). Scheduling related articles also reflect the growing complexity involved with projects as well as the increased number and efficiency of PM oriented software applications (Ragsdale, 1989; De Wit and Herroelen, 1990; Patterson et al., 1990; Speranza and Vercellis, 1993; Lova et al., 2000). Concerning management control content, Henderson and Lee (1992) explore the effects of a range of control behaviors on team performance in Gen. They emphasize the timely availability of information in projects and conclude that managerial and team-member control can coexist. The article by Kirsch (1997) takes a broad view of control – formal and informal with case studies suggesting the construction of a portfolio of control modes - appropriate pre-existing and new mechanisms of formal as well as informal control (Kirsch, 1997).

New product development (NPD) research is extensive in Gen sector (e.g. Pinto et al., 1993; Adler et al., 1995; Tatikonda and Montoya-Weiss; 2001; Gerwin and Barrowman, 2002). Pinto et al. (1993), Adler et al. (1995) and Tatikonda and Montoya-Weiss (2001) make groundbreaking arguments for organization-wide co-operation in projects, whereas Gerwin and Barrowman (2002) name integrated product development as a significant management trend for new product development and inherent projects. In general, the NPD literature in Gen argues the necessity for bringing actors, individuals or groups, from various functions involved with the project, to interact early to enable successful project outcomes. Many articles in Gen emphasize that projects differ and thus recognizing the project type context and adjust PM accordingly is essential. Shenhar (1993, 2001) and Shenhar and Dvir (1996) focus on developing a conceptual and managerial classification of projects based on technological uncertainty and complexity towards a typological theory of PM. Dvir et al. (1998) seeks an empirically-driven classification of project types and project-type specific success issues. Shenhar and Dvir's papers refer to a contingency theory of organizations. Lindkvist et al. (1998) presents a four-field typology of project logic, using type of complexity and type of error problematic as typology parameters. Pich et al. (2002) stresses the need to map the project terrain through classifying projects according to their characteristics, and Lewis et al. (2002) concludes that managing tensions is essential and using different management styles is beneficial in different phases and types of projects. In summary, Gen sector includes many articles that suggest typologization of projects and their management styles according to recognizing various parameters and characteristics in projects that make them and their requirements for management different. This can be considered to relate to structural contingency theory of organizations which asserts that the effectiveness of an organization is contingent upon the fit between structural and environmental variables. The research content in system dynamics is extensive in Gen, providing a more open-system dynamic view on a project and its management (Rodrigues and Bowers, 1996; Rodrigues and Williams, 1998; Eden et al., 2000;

Lyneis et al., 2001; Joglekar and Ford, 2005). System dynamics articles in Gen emphasize the theoretical content of defining projects as goal-oriented open systems that are unpredictable and unstable.

Eng - Engineering

Central articles in Eng sector suggest that the use of project classification is beneficial for improving the management of projects (Larson and Gobeli, 1989; Green et al., 1995; and Shenhar, 1998). Innovation is also a common theme central to PM content in Eng sector articles. Larson and Gobeli (1989) seek to understand the effect of PM structure on innovative solutions for development projects. They conclude that though the traditional functional organization is suboptimal for PM there is no one best way to manage development projects because the nature of projects and the organizations performing them varies. Green et al. (1995) develop a multidimensional measure of radical technological innovation. They suggest four radicalness dimensions that vary in degree in R&D projects with management implications: the amount of technological uncertainty involved in the project, the firm's inexperience and lack of knowledge of the scientific and technical expertise required and/or the business practices required for the project, and the cost of choosing to execute the particular project. Shenhar's (1998) two-dimensional typology (system scope and technological uncertainty) of project and PM styles found in Eng states that matching the type of project with the best management style for that particular type of project leads to superior results. This research content can be logically related to the contingency theory view of projects and their management.

Hameri and Nihtilä (1997) and Browning et al. (2002) emphasize the importance of information processes and technology in product development – Browning et al. (2002) for reducing product development risk and Hameri and Nihtilä (1997) for enabling virtual co-location of the project team. Novel ways of executing new product development projects are examined in Hameri and Nihtilä (1997). They see that the word-wide-web and internet technology have reached sufficient sophistication and reliability to enable their effective use in large distributed new project development projects. Browning et al. (2002) aims at enabling the evaluation of progress and added customer value in product development through their developed risk value method. They conclude that reducing uncertainty in product development improves affordability and thus increases customer value. Uncertainty inherent in technological projects, and the innovation and R&D nature of projects, are addressed in the PM articles in Eng sector.

Con - Construction, building, and civil engineering

The common denominator in many Con sector articles seems to be the search for the key to construction projects success through appropriate processes and computer applications. Jaselskis and Ashley (1991) suggest an improved PM process to ensure construction project success. The content in Russell and Froese (1997) and Hegazy (1999) also relate to this theme, but they also emphasize the use of computer PM applications. Choo et al. (1999) focus on developing a work package scheduling application and database. Jaselskis and Ashley (1991) comment on the complex and uncertain nature of the construction environment and seek to improve project managers' resource allocation ability. In their article, three quantitative models are developed to help predict the probability of project success. Lamm et al. (2008) analyze determinants for successful design-build projects. Schatteman et al. (2008) suggest a methodology for integrated risk management and proactive scheduling practice, which would help in managing construction projects successfully. Computer-aided management is emphasized, and adoption of new technology – e.g. web-based construction PM systems (Chan and Leung, 2004) – is seen central in the management of construction projects. Integrated computer systems for medium-sized contractors are scrutinized by Russell and Froese (1997). The article finds room for improvement in these systems to be

optimally beneficial to construction sites PM practitioners. Hegazy (1999) develops a way of considering resource allocation and leveling that is applicable within commercial PM software. We can conclude from the analysis of Con sector articles that there is an extensive content on developing means that help achieving successful construction projects, pursued through introduction of appropriate manufacturing processes within projects – including effective computer-aided resource allocation through computer applications.

Sof - Software and IT, telecom, and computers

Risk and uncertainty and their effects on projects and PM are strongly present in Sof sector articles: e.g. Ropponen and Lyytinen (2000) study six components of software development risk and their management recommending that project managers tailor the risk management efforts according to the types of risks and the project environment. Rai and Al-Hindi (2000) find that process modeling before software development project initiation can provide a useful managerial framework and also reduce uncertainty. Barki et al. (2001) suggest that deviations from planned budget and schedules, unlike in permanent functional organizations, may have critical adverse effects in projects, and they stress that a project's risk management profile needs to match its degree of risk exposure. Escalation is a major issue for Sof industry sector PM. Keil (1995) highlights the wayward nature of IT projects and the difficulty of deciding when to terminate a project. Escalation occurs due to a combination of project, psychological, social and organizational factors. Newman and Sabherwal (1996) discuss escalation and come to the conclusion that sustained commitment is a key requirement for IS project success but at the same time, avoiding escalation of commitment, over-commitment to a failing course of action, is a major challenge. "Runaway" information systems projects are discussed in Smith et al. (2001) where the organizational phenomenon of reluctance to report negative information on a project is examined. The challenge for PM practice is to create a project atmosphere that encourages open communication.

Boehm and Ross (1989) stress the need of skillful integration of software technology, economics and human relations in software PM to ensure that all the project participants are satisfied with the outcome. Liu and Horowitz (1989) develop DesignNet, a formal model for software project-management, but notes that as large software projects are complex, no model can adequately explain all projects. Hapke et al. (1994) points out that scheduling in software projects is especially difficult. Nidumolu (1996) emphasizes software development standards like milestones, documentation, and approval procedures for improving software project product and process performance even under requirements uncertainty. There are calls for more structure and rigor in software PM. However, Andres and Zmud (2001) conclude that continuously increasing complexity in software development projects requires novel PM with organic coordination and more empowerment of the individual project participants. Aladwani (2002) supports this view explaining that an information system project presents a highly interactive context where problem solving competence and other soft PM issues play a strong part. The need to educate future software engineers on the special nature of software projects and their management is evident in Pfahl et al. (2001) presenting a computer-based training application to introduce students to some of the complex decision-making and trade-off situations faced by software project managers.

Whereas the role of information and communication technology applications is emphasized in the PM articles in Eng and Con sectors, the articles in Sof sector enabling this technology stresses surprisingly the content that relate to the people-intensive nature of and complexity involved in information technology and systems projects. Based on this observation, we conclude that the research content in Con sector emphasizes the importance of computer applications in [construction] projects as a way towards success,

but the Sof sector, focusing on building these computer applications, emphasizes [software] project success being finally powered by people-related soft issues and not computer applications. The high risks and uncertainty associated with software development projects are evident in many of the Sof PM articles. Our analysis proposes the following view: though the aim of PM in Sof sector is clearly to execute projects on schedule, within budget and agreed scope, traditional PM is not enough in this sector - it needs to include more emphasis on the softer issues. In summary, the research content of the Sof sector seem to include a very original business-focused view of projects, with recognition that the ultimate aim is on continuous stream of well-managed projects in a complex network of multiple actors and stakeholders. PM articles in Sof sector emphasis psychological, social and organizational factors, particularly on relationships and their management, organic coordination, and empowerment and commitment of individual project participants. Although systematic and efficient approaches of modeling, to-the-plan execution, and other hard methods are emphasized, effective PM is emphasized to include a delicate balance between hard methods for effectiveness and efficiency, and soft methods that allow empowerment and accountability, exploration and experimentation, and flexibility in the complex and uncertain environment.

Hea - Healthcare

Costs and effecting change are Hea sector issues. Kere and Kere (1992) and Couto (2008) underscore the increasing requirement and importance of cost-effectiveness and cost-benefit in healthcare sector projects. Davidson et al. (2006) focus on target achievement and effectiveness of the change. Lorenzi and Riley (2003) find that many healthcare sector information system projects have failed especially in the implementation phase due to lack of emphasis on change management's softer people-skills side. Both technical as well as people and organizational knowledge and skills are required from a good project manager in the projects aiming at implementing changes in the healthcare sector (Lorenzi and Riley, 2003). Findley et al.'s (1989) article is part of a series on conducting research in the healthcare sector. They discuss the many aspects of PM to be considered by researchers i.e. the project manager/leader. Nair and Campbell (2008) emphasize the importance of partnerships in projects. Their case study reports challenges in bringing together the various actors and especially in ensuring the continuity of the project outcome, partnership, once the project mediating, facilitating and funding development aid organization withdraws. They argue that projects are an efficient way for implementing change given the increasing cost-benefit requirements challenge. In summary, the research in Hea sector seems to have created appropriate and rather self-originated PM content. In this respect, the PM in Hea research seems to resemble Sof sector PM: both sectors have created self-originated emphases in their PM research that focus on such aspects in PM that are relevant in projects in those specific sectors. More specifically, the PM research in Hea sector focuses on purposeful approaches for the pursuit of new technologies through contentful healthcare research, and through creation and management of complex healthcare systems not only through the relevant information system approaches, but also through organizational approaches. These organizational approaches include: management of relationships between actors and stakeholders, skill-focused management with emphasis on soft approaches for introducing changes and managing the healthcare sector.

Che - Chemical systems, chemical engineering, and oil and gas

Our analysis of the Che sector article content indicates that much of the PM research focuses on the management of complex capital investment projects under constraints of standards and regulations. Martínez and Perez (1998) recommend decomposing complex production planning of multiple batches

into projects to be planned, monitored and controlled separately but coordinated for scheduling and resource use. Nagl et al. (2003) stress the need to effectively manage early phases, the highly creative design processes, in chemical engineering projects because much of the later cost structure is determined at the front end. Consequently, Nagl et al. (2003) present the AHEAD management system, an improvement on available PM systems. Biré et al. (2004) explain that applied research in the French Food Safety Agency is mainly conducted as projects with defined objective and actions, start and end dates, and limited budget and resources. Planning, monitoring and controlling of costs, resources and risks are essential and PM promises many features that improve both product quality and research (Bire et al., 2004). New product development processes in Che sector are managed as projects (Larsen, 2005; Cheng et al., 2009). The content of PM articles in Che sector relies on rather systematic, controlled, formal and rigid PM approaches, which is due to the regulated and controlled environment of large-scale development or facility projects exhibiting remarkable societal-safety impact. Due the nature of Che sector projects, it becomes obvious that controllability and orientation towards efficient manufacturing within the projects' contexts are more emphasized, rather than towards change-PM for effectiveness, creativity, or innovativeness.

Pow - Power and energy, energy production, and energy systems

Central articles in Pow sector focuses on planning and controlling large-scale facility investments, with a significant emphasis on decommissioning nuclear power plant projects, and management of nuclear newbuild projects. Articles emphasized systematic and controlled PM for to-the-plan execution in projects where investors were seeking certainty and controllability from PM, with the focus on controlling projects and their impacts on the society. Pow sector articles research content related extensively to decommissioning of old nuclear facilities (Yanagihara et al., 2001a; Yanagihara et al., 2001b; Yanagihara, 1993; Krause, 2008). This content is strongly affected by the post-Chernobyl era, where the focus has been on deconstruction of nuclear energy systems rather than new systems construction. Importance of effective PM is emphasized for decommissioning projects (critical for safety, environmental and other societal reasons) in articles including empirical content from Japanese ,German and Scottish projects (Yanagihara et al., 2001b; Krause, 2008; Welsh, 2001). However, many of the articles also included content of the ITER project (International Thermonuclear Experimental Reactor) which is a major international research project on nuclear fusion technology (Chiocchio et al., 2007). This ITER project represents the orientation towards new advancements in nuclear energy and reinstatement of nuclear power as an energy source.

Env - Environment and sustainability

Env sector research brings forth long-term effects of various societal solutions. Article content reflected concern over harmful societal effects, related challenges, and remedial actions as a curative medicine (Buehlman et al., 1998; Schilling et al., 1994). Five specific themes appear in PM-related Env sector articles. First, waterways management through PM is an important and often international issue (Sawyer et al., 2009; Nijland 2005; Holmes and Nielsen, 1998; Roos et al., 1991). Article content included environmental issues related to rivers that cross several countries and therefore have cross-national environmental impacts. Second, developing countries may arguably be about to repeat mistakes made by developed industrialized countries (O'Brien et al., 2008; Fore and Clark, 2005). This was apparent in article content discussing paradoxical means and goals of recipient and donating nations in development aid projects (O'Brien et al., 2008; Davidson et al., 2007). Third, Env articles focus on facing the challenges due to past mistakes and solutions for future decades (Tam, 2008; Hartig et al., 1996). Fourth,

sustainable development requires intervention through environmental arena legislation and inherent PM (Manning, 1995; Salk et al., 1999; Anhava and Kolehmainen, 1994). Fifth, articles exposed a wide range of stakeholders and actors, both public and private, and harmonizing their interests (Jones, 2006; Boguski et al., 2007; Jobert et al., 2007; Buehlman et al., 1998).

Bio - Biotechnology and pharmaceutical

Case (1998) and Sensabaugh (1998) submit that the high level of regulation in the Bio sector affects product development processes to become increasingly lengthy and costly. Furthermore, Case (1998) and Püchler and Rennecke (2005) argue that biotechnology and pharmaceutical industry increasing tends to use projects to distance the particular development process from the functional organization. Best performance is observed when project teams are empowered, emotional commitment is high and the project leader and participants are co-located, though "virtual" co-development projects involving external parties also emerge as a growing, cost-effective product development trend (Case, 1998). Biopharmaceutical industry projects demand management of multiple stakeholders through an experienced PM team (Panico, 2004) appropriate project team design with regard to capabilities, and systematic communication plans to different stakeholders (Mejillano et al., 2007). Clinical research processes form a special type of project that focuses on integrating team capabilities emphasizing project outcomes (Odeleye et al., 2001). Sensabaugh (1998) describes more efficient and improved review process functions of the U.S. drug approval authority FDA's Center for Biologics Evaluation and Research. Regulatory submissions are worked on as projects with definite objectives, time limits and allocated resources. The project team consists of experts in the scientific and regulatory aspects of the substance in question and PM includes review milestones at pre-set intervals (Sensabaugh, 1998). In summary, articles in Bio sector emphasize PM evidently focused on managing costly and lengthy product development processes in a highly regulated environment. Efficient manufacturing processes within the development projects is focused on, but due to the high-technology and knowledge-intensive nature of projects, achieving such efficiency also relies on soft management issues and an open system view, e.g. empowered project teams, leadership, commitment, colocation, and managing effectively stakeholders and external parties even in the geographically distributed project/business environments.

Spa – Space and aerospace, aircraft engineering

Spa sector PM emphasizes developing new technologies as outcomes. Projects are managed as network organizations, i.e. PM focuses on managing the multi-organizational setting towards shared goals described in terms of ambitious technological outcomes (Wanhainen and Tyburski, 1996). The aircraft industry related articles in Spa sector accentuates increasing aircraft transportation capacity requirements (Statham and Kleiner, 1996), while aerospace articles are oriented toward emphasizing PM perfecting technical details and at the same time developing novel technologies (Huntoon, 1999). Alternatively, aerospace and space technologies (e.g. space shuttle and rocket and satellite communication technologies) were emphasized in aerospace but the same research content was represented as potential solutions for the aircraft engineering (Spear, 1999; Statham and Kleiner, 1996). Also cross-fertilization between the space sector and many other industries and sectors through innovation diffusion is emphasized. The business environment in Spa sector includes substantial public and private organization collaboration in projects at an international level (Mendell, 1998). This is advanced by involving international umbrella organizations in projects, and including cross-national schemes with strong global, societal and political orientations (Gilruth et al., 2006). The PM role is apparently a competitiveness issue for US aircraft industry and aircraft engineering actors and also for aerospace and space technologies advancement. Articles expose

several international umbrella organizations that are established for space exploration joint projects. Strong public and private organizations and collaboration is an important issue in projects in Spa sector evidenced by article content on increased efficiency pressures, e.g. in NASA's operations (Spear, 1996). Furthermore, Spa articles underscore product development teams, concurrent engineering, and systems thinking in the management of projects.

5. The similarities and differences in the PM content across sectors

This section addresses RQ2 ("What are the similarities and differences in the PM content across sectors?") by using the seven key areas derived from the analysis as the basic structure to compare the PM content in the sectors. These seven key PM areas are: modeling; management control; contingency view; innovation and development; open system view; network management, and; people-focused approach. We use this PM's subdivision into seven key areas to provide a more general view to observed PM content. We also consider this seven key areas structure facilitates development of a universal PM theory. We explain each key area separately by introducing how the key areas are represented in each sector. Thus, similarities and differences between sectors are explained at the detailed level of seven key areas. Furthermore, accepting the notion that seven key areas provide a meta-level structure of component parts of PM, we argue that the content descriptions of the seven key areas in this section introduces a meta-level anatomy of PM that is derived from knowledge across the sectors. Table 3 summarizes how the seven key areas (in columns) are represented in the sector-specific PM content of the nine sectors. Having 'no dominant focus' on some key areas in some sectors (indicated in Table 3) helps to emphasize the relative differences in the significance of the key areas in a specific sector: e.g. a 'no dominant focus' in some key area of a sector emphasizes the relative significance of another key area in that same sector that is represented.

Table 3. Summary of how the seven key areas are represented in the sector-specific project management contents of the nine sectors

Sector	Key areas						
	Modeling	**Management control**	**Contingency view**	**Innovation and development**	**Open system view**	**Network management**	**People-focused approach**
Gen - General management	Modeling focus especially on scheduling and resource allocation, computer-supported modeling, modeling risks and risk management.	Control of projects through using firm-level profitability criteria, computational applications on time/cost tradeoff, risk and criticality, and multi-criteria optimization.	Internal project contingencies, hierarchical management control for imposing tailored project management approaches, project typologies.	Projects as vehicles for innovation, projects as NPD processes, collaboration between the project's actors, integrated management across functions.	Projects as dynamic, goal-oriented open systems, with aspects of managing actors, stakeholders, and their networks in complex environments.	Control-oriented approach to the management of the project's internal network of actors (but no dominant focus on external stakeholders and external contingencies).	No dominant focus.
Eng - Engineering	Modeling of engineering-related information, risks of project execution, normative and systematic managerial approaches.	Project management as a vehicle for controlling the technical engineering work, tailored management approaches for technical work in various engineering disciplines.	Management of complexity and uncertainty in engineering and inherent business environment.	An engineer's mindset, exploration and experimentation for new solutions, research as a method for creating novel solutions, management of innovations.	No dominant focus.	No dominant focus.	Development of the capabilities of engineers, the role of engineers and engineering mindset for the effectiveness and progress of projects.
Con - Construction, building, and civil engineering	Modeling focus on construction technology and technical civil engineering applications, computer-supported processes, hierarchical contract organizations among construction and civil engineering firms.	Hierarchical project control of the owner or main contractor, controlled and disciplined focus on construction technology modelling and information management, with supporting computer applications.	No dominant focus.	No dominant focus.	No dominant focus.	No dominant focus.	No dominant focus.

Sof – Software and IT, telecom, and computers	Modeling of goals, project outcome and benefits in the complex networked environment, modeling of risk and escalation, soft methods that allow empowerment of people and accountability, exploration, experimentation, and flexibility.	Processes for matching the project outcomes to customer's product requirements, balancing between systematic process approach and modeling for management control and softer and more flexible approaches that allow using innovativeness and creativity for deliberate goal achievement.	No dominant focus.	No dominant focus.	No dominant focus.	Management approaches for the management of a complex network of multiple actors and stakeholders.	Organic and people-focused organizational view on complex and uncertain business environments, including challenges with managing among people representing various technologies and stakeholder organizations.
Hea - Healthcare	Goal-orientation in the modeling of the project outcomes through modeling of pursued new technologies and processes in the healthcare sector and healthcare organizations.	Healthcare technology and business context related management approaches in projects, suited for the management approach is healthcare organizations.	Aiming at an outcome aligned with various organizations' interests, with project scopes that often relate to the structural change of the healthcare sector, including research, creation and implementation of complex healthcare production systems and information systems.	No dominant focus.	Open system approach for involving many actors and stakeholders, for an adaptive project with appreciation of different interests and goals of the involved actors and stakeholders.	High-level societal view on a complex network of external stakeholders with various aligned and/or conflicting interests, a focus on goal orientation and purpose-driven approaches for creating a feasible outcome/solution.	No dominant focus.
Che - Chemical systems, chemical engineering, and oil and gas	Modeling focus especially on an investment project and on assuring the certainty of the associated technology, pre-planning (or modeling) of large-scale development	Projects are seen to-the-plan manufacturing devices that increase certainty and controllability, mainly for investors and financiers positioned in the down-stream of	No dominant focus.	No dominant focus. (in the literature of this sector, lack of R&D and innovation in the management of projects is argued to be the result of too controlled, rigid, and disciplined	No dominant focus.	No dominant focus.	No dominant focus.

	or facility investment projects for certainty and controllability.	supply chains requiring certainty in their large-scale project developments.		project management approaches).			
Pow – Power and energy, energy production, and energy systems	Modeling focus in planning and controlling large-scale facility investments, decommissioning nuclear power plants (increasing focus in the post-Chernobyl era), management of nuclear newbuild projects.	Systematic and controlled project management for to-the-plan execution of facility investment projects, investors seeking certainty and controllability from project management, focus on controlling future nuclear power projects and their significant impacts on the society.	No dominant focus.	No dominant focus.	No dominant focus.	No dominant focus.	No dominant focus.
Env - Environment and sustainability	Modeling of project‘s goals, foresight of benefits from the project and its outcome, modeling of future effects (negative or positive) of environment related natural and manmade changes.	Focus on the long-term societal effects and sustainability in the management of projects, the long-term effects in the management focus in environmental projects relate to the mistakes made in the past, remedying them, and development of sustainable solutions for the future decades, through continuous search for purpose-driven approaches in projects for creating a project outcome with long-	No dominant focus.	No dominant focus.	The open system view is emphasized through focusing on societal and political issues and relating national issues to wider cross-national areas, the project is approached as a high-level open system with societal and cross-national views.	Management of a network of stakeholders and actors and their interests at all levels from policy making to implementation, with a view on long-term effects of cross-national endeavors, and societal and political issues.	No dominant focus.

		term sustainable effects.					
Bio - Biotechnology and pharmaceutical	Modeling of the technological project outcomes and uncertainties, projects being seen as organizational entities that include the necessary collection of individuals and their specialized capabilities for the required outcome.	Balance between hard methods for effectiveness, efficiency and controllability, and soft approaches for people-focused leadership, flexibility and innovation.	No dominant focus.	Projects and project management as vehicles for innovation and new product development processes.	Management of the highly regulated but dynamic business environment through projects, openness is introduced in projects across many firms, public organizations and authorities collaborating internationally.	Collaboration between firms in projects that are organized as networks of firms and public organizations, a partner-focused view towards multiple actors and stakeholders, effective use of partners with appropriate capability, skills, and specialization in knowledge intensive and cross-disciplinary projects.	People-focused leadership for flexibility and innovation in projects with collaboration between firms, public organizations and their networks.
Spa – Space and aerospace, aircraft engineering	Modeling of new technologies (as project outcomes) with research focus.	Projects are managed as temporary organizations, i.e. in a multi-organizational setting towards the shared goals described in terms of the ambitious technological outcomes.	No dominant focus.	Innovation diffusion through cross-fertilization between the space sector and other industries in projects, open international collaboration in projects between firms, public organizations, and international umbrella organizations.	The open system view is emphasized through introducing high-level societal and cross-national perspectives in the complex project network of external stakeholders, collaboration among public and private organizations in projects for addressing societal and political issues, and cross-national impacts.	Managing projects as collaboration networks of multiple international and public-private organizations, including international umbrella organizations and cross-national bodies with strong joint/shared goals in global, societal and political issues.	No dominant focus.

Modeling

The modeling area includes pre-planning of the project or its outcome. The modeling content in the PM research articles emphasize planning – or modeling – in advance, and the role of a plan as a purposeful prerequisite for controlling the work for adherence to a predetermined plan. We adopted the term modeling from the term's extensive use in all PM sectors. Classical modeling as a core PM content is seen in Gen, where project execution planning through scheduling and resource allocation is a core research content. Furthermore, computational applications and computer-supported modeling are central to Gen as is modeling risks (or analyzing risks) in project risk management. Modeling is a relevant area of PM research in Gen, Eng, Con, Sof, Hea, Che, Pow and Env, but all these sectors, however, have their own, sector specific modeling content that is characterized by e.g. various emphases with scheduling, resource allocation, cost, risk and uncertainty, coordination, management and decision making, system dynamics and performance.

In Gen modeling research is especially strongly associated with scheduling and resource allocation as supporting planning the project in advance with optimal accuracy for the whole execution. Eng sector, by contrast, modeling is mainly related to planning and managing the innovation and design process from a business perspective. The modeling content in Con is strongly tied to cost – enabling calculation of impacts and time-cost tradeoffs, but Con modeling also relates to pre-planned use of external contractors and suppliers. Con research includes computer-supported development which Con perceives as a management support tool for developing appropriate plans that enhance systematic PM. This differs from the computer-supported modeling content in Gen where modeling is used for original research focusing on scheduling that represents the roots of PM. The Modeling content in Sof is perhaps the most varied but with greater content on soft, people related issues such as effort, capability maturity and coordination but also project escalation. In some sectors (Sof, Hea, and Env), the emphasis seems to be on modeling the outcome (technology, product) of the project, implying a goal-oriented focus with project outcome benefits foresight. For example, in Env sector, the need to model both natural and manmade environmental change effects facilitates strong support for sustainable development.

Management control

The management control area includes research on systematic approaches to control the project's execution of pre-set objectives. Management control therefore includes processes analysis that describes a project as a manufacturing-to-the-plan vehicle or a strategy-guided-implementation scheme. The management control research area addresses approaches that rely on linear and mechanistic systematic processes – e.g. manufacturing process – rather than being organic or people-focused. One underlying rationale is to increase certainty in the complex environment, by establishing controlling procedures that assure that someone is in charge (the project's/firm's management) making decisions about the goals (connected to the strategy within the company hierarchy) and processes in place that ensure that the manufacturing/execution is efficient and controlled (e.g. eliminating unnecessary deviations from pre-set goals).

Management control includes approaches that mostly rely on hierarchies where objectives and control of implementation is cascaded from higher-level executives, either from the firm-level (in Gen sector) or

within a project from the owner or main contractor (in Con sector in a contract organization with multiple subcontractors), or from the PM to their subordinate managers or team members (all sectors). Management control comprises a strong area of research content in Gen, Eng, Con, Sof, Che, Pow, and Bio. Naturally, many of these sectors are the same where the modeling research content has a strong role. This occurs because both management control and modeling research areas rely on systematic management, and on most sectors the approach is focused on to-the-plan project execution, according to a pre-modeled scheme. Che and Pow management of project sectors is often associated with large-scale development or facility investment projects. Investors and financiers of such investments seek certainty and controllability for their large-scale investments. Asset specificity in such projects is high, and significant regulation is established in building such capital goods in the industry. In Che and Pow sectors, therefore, significant preparation and pre-planning of projects are established, and projects and their management are considered as to-the-plan manufacturing devices increasing certainty and controllability. A special feature in the regulated environments of these two sectors is in the nuclear power area in Pow, where particular emphasis in nuclear safety introduces special requirements to projects and their management. Research in these sectors even argues that systematic and controlled PM approaches are excessively rigid and disciplined, particularly for innovation and development. In Con, a special emphasis within the management control research content focuses on computer-supported applications and their role in enhancing management control within construction and civil engineering projects.

Contingency view

Contingency view research content is strongly present in Gen and Eng. PM research in both sectors cover areas involving various engineering disciplines and projects with cross-disciplinary content from various application areas. Therefore, naturally, contingency research that addresses different PM styles and their applicability for different types of projects or different application environments. Gen and Eng articles address a contingency view focus mostly on contingencies that are project internal rather than external. Therefore, the research appears to favor making a distinction between different project types as defined by their internal parameters (contingencies), and suggesting different PM approaches for different project types. Furthermore, Gen and Eng contingency view articles emphasize the importance of contingencies, but once these are identified, suggested PM approaches rely on hierarchical and/or linear management control approaches (see the management control area above) that have been tailored to fit the contingencies.

Based on the above, we can criticize the existing contingency research content for focusing merely on contingencies internal to a project (serving as parameters for project types) and for suggesting excessively linear and rigid PM approach for each project type. We trust that our research investigating PM research in various sectors also implicitly broadens the contingency view to different projects and their management in different sectors, regardless of explicitly defined parameters/contingencies that may be addressed in future research. However, the ‘open system view’ research area (see below) broadens the perspective from what the existing contingency research in Gen and Eng is criticized: open system view research area addresses the project as an integrated part of its external environment. This view emphasizes a project (and its environment) as a dynamic system requiring a PM approach that is reflective on changes in a constantly adapting environment.

Innovation and development

Innovation and development content in articles appears strongly in Gen, Eng and Bio mostly in the form of seeing projects and their management as an innovation vehicle. This perspective introduces management approaches that are designed for creating novel technological or commercial outcomes in projects. The research content in articles relies mostly on systematic management of well-controlled development work: for example, Gen, Eng and Bio articles look projects as new product development (NPD) processes. Therefore, PM is addressed by using the extant NPD literature as a conceptual and theoretical basis. A systematic NPD process, and its integration within new product development, raises research content as being central to the management of new product development and inherent projects. Organization-wide co-operation in projects is another central research theme: especially in Gen, existing research argues the necessity for bringing actors, individuals or groups, from various functions involved with the project, to interact early in order to enable successful project outcomes. Finally, the Gen sector's NPD articles emphasize the theoretical innovation content of: collaboration among the involved project actors, individuals and groups; facilitating their interaction; enhancing cross-functional and cross-disciplinary management in an integrated manner, and; putting weight on the pre-project/front end phase related activities in the organization.

Open system view

Open system view research content emphasizes the project and its management as an open system and an inseparable part of its external environment. This view introduces dynamism to a project and its management: the project and its goals are ever-changing in the uncertain and complex environment that transforms during the project. Article content emphasizing an open system view implies that suggested PM approaches must be adaptive rather that contingent on specific pre-determined contingency parameters and their suggested approaches. Thus, this view broadens –even contrasts – the contingency view that focuses on identifying specific parameters – mostly internal – within a project, and on issuing management approaches – mostly generic and static PM approaches.

The open system view research content has a central role in Gen, Env and Spa articles, but less so for many other sectors (e.g. those representing traditional specific engineering disciplines e.g. Eng, Con, Sof, among others) where PM appears more focused on only modeling (see the discussion on modeling research area) and systematic management control (see the discussion on management control research area). The open system view content articles in Gen, Env and Spa, highlight the external environment of a project being considered where the PM is carefully matched to the ever-changing environment and context. This enhances ultimate goal orientation and purpose-driven approaches in some sectors (e.g. Env where the cross-national level within projects are emphasized for developing sustainable solutions that cross national boundaries). The open system view expands the PM view to wider levels of policy-making and cross-national collaboration. Env and Spa PM articles for example focus on a high-level societal and cross-national perspective of complex external stakeholder networks. Finally, the open system view emphasizes the importance of networking, collaboration, and capabilities of various parties, therefore the open system view research is to some extent related to network management area research content (see below) where the network management issue is however more focused/limited to coordination of the internal – and not external – network of actors and organizations within a single project.

Network management

Network management area emphasizes the management of a project as a network of multiple organizations and individuals. Accordingly, the network management view considers the PM as a dynamic organizational scheme and the project as a changing organizational setting where multiple actors with different interests must be managed simultaneously. Network management research therefore sets another paradigm that contrasts pre-set, process-like, and vertical hierarchy focused management approaches in the management control content. Network management content includes research that is focused on managing the project's internal network of actors and stakeholders, whereas the focus of the open system view is related more to embedded management schemes within the project's external dynamic environment and its associated actor network.

Whereas the emphasis of open system view research is in dynamism and PM as a dynamic device partly contingent on ever-changing external circumstances, strong network management research content in Gen, Sof, Hea, Env, Bio and Spa sectors, depend on investigating more rigid and/or more control-oriented approaches to the management of the project's internal network. For example, the highly regulated Bio sector the network management issue concern systematic and formal – often contract-based – partnering arrangements among firms, public organizations and authorities that collaborate internationally. Therefore, network management within a project can be considered to be formal – even rigid, despite the fact that the underlying motive is based on rather soft issues relating to partners with appropriate capability, skills, and specialization in knowledge intensive and cross-disciplinary developments within the networked project.

People-focused approach

The people-focused research approach concerns individuals or team management. The focus on people emphasis obviously comes from two underlying characteristics of projects and/or their environment. First, uncertain and complex technologies, markets and organizational settings requires relying on people and their competencies and problem-solving abilities, rather than merely on detailed planning and systematic management control procedures. Second, using competent and experienced people is believed to enhance flexibility in projects with ambitious goals with innovative outcomes and effects that cannot be pre-determined in the form of detailed planning.

Eng, Sof, and Bio sectors include research emphasizing a people-focused approach. Surprisingly, the people issue is not addressed by PM research in most sectors. For example, it is surprising that the role of people and their management was not particularly emphasized in Gen, however, the research in Gen and Hea referred to the importance to balance 'soft management methods' with 'hard' ones, but without particularly explicitly examining the people issue as a potential issue that may be associated to something that is defined a soft method. Eng, Sof, and Bio emphasizing a people-focused research content approach is quite different in each of these sectors. The Eng people-focused approach especially concerns the development of the capabilities of engineers in general, e.g. in educational programs. Sof, emphasizes a people-focused approach as an organic and people-focused view of complex project organizations within complex and uncertain business environments where the technological cross-disciplinary scheme (with embedded IT and software) pose challenges to people and stakeholders. Bio research recognized people as important but the importance of people is treated as a component that relates to extensive collaboration schemes among organizations; in this respect, Bio research emphasizes the importance of people-focused leadership for flexibility and innovation in projects with collaboration between firms, public organizations

and their networks, but does not address specific people management or leadership issues. Generally, for people-focused approach research content, the people issue is mostly associated with introducing flexibility in the overall PM scheme through capabilities that individuals bring to complex and uncertain project settings.

6. Contributions, and the potential consequences of sector-specificity for developing the PM domain in the future

This section discusses the contributions of this research, by simultaneously addressing RQ3 ("Why is PM understood differently in different sectors, and what are the potential consequences of sector-specificity for developing the PM domain in the future?") and connecting the contents of the previous analysis sections addressing RQ1 and RQ2.

We make three PM research contributions. First, our research exposes the existing *sector-specificity* in PM through introducing different PM content in sectors. Second, based on the findings, we suggest explanations about differences between sectors, these answer the question *why PM is different in different sectors*. Third, the findings contribute both to the development of *multiple PM theories* or, if appropriate, *one universal PM theory*. We discuss each of these three contributions separately under the following rubrics 6.1, 6.2, and 6.3.

6.1. Sector-specificity

First, our research exposes existing sector-specificity in PM through introducing different PM content that come from different origins of technology-focused and engineering journals connected to different sectors. This complements previous research that has explained and theorized PM only within the discourse of management studies. The network and people-focused approaches in the software and IT sector, or the open system view of a complex stakeholder network with various aligned and conflicting interests in the healthcare sector, or the open collaboration across firms and public organizations globally in the biotechnology sector, are examples of sector specific PM content that have an original emphasis and therefore differ from the general definitions of PM approaches reported in existing management studies. Our observations of sector-specificity increase variation in interpretations of how PM can be defined: as the original purposes and underlying assumptions of PM are sector specific, there are original development paths in each sector accordingly, e.g. reliance on flexible management approaches that are in the software and IT sector contained in the concept of agile and its inherent developments.

6.2. Explanations about differences between sectors: why

Our findings open up avenues for explanations that answer the question 'why PM is different in different sectors'. This 'why' question, differences between sectors, can be explained by the dominant role of developing both technical and managerial content within each sector hand-in-hand, institutionalized patterns in sectors, and the nature of technology-focused of practical applications in sectors that pose specific needs for special sector specific managerial approaches. One significant lesson from observed differences between sectors is that management approaches and processes (i.e. PM content) cannot be separated from what is managed (i.e., the technology, related to the question whether the project's end-product is a new building, or a new biomedical medicine). Each sector is a different context for a project

and its management, all levels (project, firm, industry) affected by sector-specific market mechanisms, specific technologies and their underlying theories that must be mastered. Capability requirements relate to these technologies and associated technologies as well to interface management together with how development of these technologies can be managed in projects and in general, similarly for logics that influence governance and organizing, collaborating, and competing in the sector. This relates to the contingency view – or contingency school – of PM, originally introduced by Söderlund in 2002 and followed by a more recent study by him in 2011 introducing the contingency school (Söderlund, 2002; 2011). However we argue for more than just focusing on contingencies in a project's management: The sector-specific management knowledge synthesized in this paper can be used to argue that there are multiple PM domains or theories, e.g. a distinct PM theory per sector that is based on the knowledge and wisdom published within the boundaries of the sector. Alternatively, this sector-specific knowledge can be integrated across sectors for universal knowledge about PM, and in this case, we could argue that the universal PM theory includes modularity (rather than is designed for taking into account contingencies in the management of a project): modules of different constructs (knowledge, organizational, or other) can be used for introducing different modular approaches in specific sectors. We discuss the development of both multiple PM theories and one universal theory in more detail in section 6.4.

Regarding Sof sector and the above 'why' question, We argue that because software and IT solutions are always connected to other technologies of other sectors and industries (e.g. software and automation embedded is a passenger car) it is therefore a necessity that a software project is strongly connected to a bigger whole where different technologies and disciplines are included. Therefore, it is evident that a software or IT project must connect itself to a network of multiple organizations representing these technologies and disciplines, for example to the customer, user, and other stakeholders. Accordingly, software projects must take a wider environment into account while simultaneously implying a rather controlled approach to deliver to external parties and adjust to their ever-changing requirements. Logically, it seems obvious that Sof sector PM content is an interesting balance between the network and people-focused approaches for flexibility, and modeling and management control approaches for simultaneous adaptation and delivery. Based on the above reasoning, it is no wonder that the PM research in Sof is extensive (most PM articles per sector, and the biggest number of journals where these articles are published) representing an original PM domain of its own right.

Regarding Con sector, obviously the modeling and management control focus through pre-planning, linear and computer-supported execution processes, and vertical supply chains in project-specific contract organizations, are due to the maturity of the technology and market: projects in Con sector tend to assume that the project's end-product and its execution must be planned in detail, preferably with the support of computers that guarantee predictability and procedural efficiency. Resourcing for execution is considered as just being one part of the project that requires planning at the detailed level of resource use thus limited emphasis to organizing or people, because organizations and people are considered as resources being abundantly available in a mature market. Che and Pow sectors share a similar modeling and management control emphasis as the Con sector, but for other reasons. Che and Pow, projects are often large-scale facility investment projects that are mission critical for the investors' businesses; therefore PM in Che and Pow is applied to increasing certainty and controllability for investors, and detailed modeling/planning and accordingly, tight management control is used to accomplishing certainty goals. Che sector literature criticizes this kind of PM content as being often excessively controlled, rigid, and disciplined approaches, impeding R&D and innovation in the managing the sector's projects.

The ‘why’ PM in Hea sector question emphasizes goal modeling of and purposeful management control for the accomplishments among public and private organizations with an open system view to the environment. This kind of focus is due to the vividly developing healthcare sector where many projects are established for implementing new technologies and processes to practice. The achievement of these project goals requires strong collaboration among multiple public and private organizations, and even among organizations from other sectors (e.g. the technology developers from other sectors). Bio sector (biotechnology and pharmaceutical) is rather regulated globally, and therefore, despite strong emphasis on an open system view and networks at an international level, due to the regulatory environment, there is also robust emphasis on modeling and management control to follow the regulatory process requirements in projects. Env and Spa sector open system and network views expand the PM to wider levels of policy-making and cross-national collaboration in a complex network of external stakeholders. Both sectors emphasize modeling and management control concerns, project outcomes and significant future technological and societal accomplishments shared across nations. The Env cross-national view on sustainability goals in projects and networked project are naturally dominant. Saving rivers, seas, and the climate as projects objects are geographically positioned across several countries’ land: environmental problems in any country would spread to other countries necessitating political and strategic-level joint efforts. Furthermore, Spa sector also emphasizes policy-making and cross-national collaboration in open systems and networks, but due to the complex space and aircraft technologies and ambitious developmental goals in projects, a delicate balance between innovation and disciplined modeling and management control approaches are needed for mastering the complexity in the technology.

6.3. Multiple PM theories vs. one universal theory

The findings contribute both to the development of multiple PM theories (each being built on the existing knowledge and literature discourse in a specific sector), and to the development of one universal PM theory. Based on our sector-specificity findings, we argue that PM can be used as a meta-level concept that covers several different PM domains or theories (of sectors). Underlying assumptions, theoretical backgrounds, constructs, relationships definition and logics, for each of sector-specific theory is different. Building a theory requires that such assumptions, constructs, definitions, and logics, are first elaborated to set a foundation for such theorizing. Fundamental underlying assumptions and logics differ by sectors so it may be natural that there are multiple theories separately created based upon each sector’s published knowledge and wisdom. Alternatively, the findings in this study have a significant potential to contribute to the scholarly discussion on the development of a universal PM theory. This discussion has been currently focused mainly in theorizing on the concepts and approaches in management studies only.

If we accept the notion that the seven key areas provide a meta-level structure of component parts of PM, then we can argue that the content descriptions of the seven key areas in this section introduces a meta-level anatomy of PM that is derived from knowledge across the sectors. Table 4 summarizes the sector-specific management knowledge by the seven key areas. The key areas and the inherent findings in Table 4 can be used for developing sector-specific PM theories, or a universal PM theory. The universal PM theory could include modularity: the management modules could be different in different sectors, formulating a unique composition of PM for each sector from modular component parts

Table 4. Project management content looked through the seven key areas and their sector-specific management knowledge

Key area	Summary of the evidence from the project management knowledge in sectors
Modeling	Modeling is emphasized in Gen, Eng, Con, Sof, Hea, Che, Pow, and Env, as pre-planning of the project or its outcome. Various specific modeling contents in sectors are characterized by different approaches to scheduling, resource allocation, cost, risk and uncertainty, coordination, management and decision making, and system dynamics and performance. In Sof, Hea, and Env, the specific emphasis is on the modeling of the outcome (technology, end-product) of the project, where the focus is on the project's goal with foresight on the benefits of the project and its outcome. The classical modeling as a core project management content is seen in Gen, where the planning of the project execution (and not the project's outcome) through scheduling and resource allocation is emphasized, flavored with computational applications and computer-supported modeling. Computer-supported development is emphasized in Con more extensively as a holistic management support tool for developing appropriate plans that enhance systematic management of the project.
Management control	The management control area in Gen, Eng, Con, Sof, Che, Pow, and Bio, includes various systematic approaches to control the project's execution. The management control area include approaches that rely on systematic processes that are linear and mechanistic – like a linear manufacturing process – rather than e.g. organic or people-focused management control. We argue that both management control and modeling areas in many sectors go hand-in-hand by relying on systematic management procedures, and therefore the management control is often seen as a systematic management approach that is focused on to-the-plan project execution, i.e., for ensuring that the project is executed according to a pre-modeled scheme. In the highly regulated Che and Pow sectors the management control in projects is often associated with large-scale development or facility investment projects where project management is applied for increasing certainty and controllability. In Con, a special emphasis within the management control content is on computer-supported applications and their role in enhancing management control in construction and civil engineering projects.
Contingency view	The contingency view is strongly present in Gen and Eng. In Gen and Eng, articles addressing the contingency view focus mostly on contingencies that are internal rather than external to the project. Furthermore, Gen and Eng articles addressing the contingency view emphasize the importance of contingencies, but once the contingencies are identified, the suggestions on project management approaches rely on the hierarchical and/or linear management control approaches that have been tailored to fit the contingencies. Such contingency management content for focusing merely on contingencies internal to a project (serving as parameters for project types) and for suggesting linear and rigid project management approach for each project type, can be seen as representing a rather narrow view to a project's management. We see that the open system area broadens such narrow (and too operational) perspective on contingencies: in the open system view the project is seen as an integrated part of its external environment, and therefore the open system view emphasizes that project is a dynamic system that requires a project management approach that is adaptive on the changes in the environment and. And therefore the project's management must be is adjusted continuously during the project's execution.
Innovation and development	Innovation and development content is strongly represented in Gen, Eng, and Bio, mostly in the form of seeing projects and their management as a vehicle for innovation. This perspective to projects and their management is seen in Gen, Eng, and Bio through emphasis on management approaches that are designed for creating novel technological or commercial outcomes in projects. The management content these sectors relies mostly on systematic management of well-controlled development work: for example, Gen, Eng and Bio articles view projects as new product development (NPD) processes. Therefore, NPD processes and their management are adopted as devises for managing the projects, and accordingly, the project management is theorized by using the extant NPD literature as a conceptual and theoretical basis.
Open system view	Open system view in sectors emphasizes the project and its management as an open system. The open system view is in a central role in Gen, Env and Spa articles, but not so much in many other sectors (e.g. those representing traditional specific engineering disciplines like Eng, Con, Sof, among others). The open system view in a project's management is seen through addressing the dynamism in the project and its management: the project and its goals are managed as ever-changing systems in the uncertain and complex environment. The open system view therefore emphasizes the dynamism in the project's external environment, with the perspective of the project belonging as an inseparable part to its environment. Therefore, the open system view emphasizes the importance of networking, collaboration, and capabilities of the various parties in a project's management. In Env, the open system view emphasizes goal orientation and purpose-driven approaches in projects for developing sustainable solutions that cross the boundaries of nations. In Env and Spa, the open system view expands the project management view to wider levels of policy-making and cross-national collaboration in a complex network of external stakeholders.
Network management	Network management is strongly emphasized in Gen, Sof, Hea, Env, Bio and Spa sectors. This area is addressed by project management articles which consider the project as a network of multiple organizations and individuals. Accordingly, the network management introduces the project and its management as a dynamic organizational scheme, and the project is considered a changing organizational setting where multiple organizations with different interests – aligned and conflicting – must be managed simultaneously. The network management content therefore sets another paradigm that contrasts – or complements – the pre-set, process-like, and vertical hierarchy focused management approaches in the management control content. Whereas the emphasis of open system view research is in dynamism and management the project as a dynamic system, partly contingent on ever-changing external circumstances, the strong network management research content in Gen, Sof, Hea, Env , Bio and Spa sectors relies on looking at a more intentional and control-oriented approach to the management of the project's internal network. For example, in the highly regulated Bio sector the network management issue concerns a rather systematic and formal – often contract-based – partnering arrangements among firms, public organizations and authorities that collaborate internationally.
People-focused approach	The research on people-focused approach concerns the management of individuals or teams. Eng, Sof, and Bio sectors include research with emphasis on people-focused approach. It is surprising that the people issue is not addressed in the project management research in most of the sectors. In the research content with people-focused approach, the people issue is mostly associated with introducing flexibility in the overall project management scheme through capabilities that individuals bring to the complex and uncertain project setting. In Eng the people-focused approach especially concerns the development of the capabilities of engineers, in Sof the emphasis on the people-focused approach is in organic and people-focused view on complex project organizations within complex and uncertain business environments, and in Bio people are recognized as important carriers of capabilities but the importance of people is treated merely as component parts in bigger collaboration schemes among organizations.

7. Further research

Our findings open up two avenues for further research. First, as our study on the PM knowledge in different sectors is the first research of this kind (i.e., comparison of PM domains in different technology-focused sectors while previous research has limited itself into looking at management studies), we suggest that future research continues digging deeper into theoretical PM knowledge by selecting one sector, and theorizing on PM by building such theorizing only on the published knowledge developed in that specific sector. Such development of a sector-specific PM theory will require that assumptions, constructs, definitions, and logics, which relate to such theory are introduced at a detailed level. This new knowledge will definitely be contrasted with existing PM knowledge, therefore complementing the current understanding of PM and its applicability in different sectors and contexts. We welcome such research on any sector, but based on our data and findings we suggest that researching the collective knowledge and wisdom in Sof sector publications for theory development purposes would be fruitful. This occurs as our study show that the PM research in Sof sector is extensive and rich in content, and this extensive research also indicates that application of PM in various forms and in various purposes is extensive in Sof sector.

Second, we welcome research on the development of universal PM theory that uses the findings of this study on sector-specific PM content. Development of the universal theory would benefit from the seven key areas derived in this study, and the detailed PM content descriptions of these key areas per sector, explaining the similarities and differences across sectors. The question is not only about what we can learn from sector-specific knowledge for the development of the universal theory, but how universal theory should include applicability of the suggested PM widely in all project across all sectors (otherwise, the theory would not be universal). We also welcome future research that would develop our suggestion for using the understanding of the similarities and differences across sectors to develop a universal modular theory, where different modules of the theory (connected to knowledge, concepts, or assumptions, for example) would be used in different sectors.

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