Towards a taxonomy for project management competences

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Abstract

Introduction

A taxonomy is used for classifying things in general. For the purpose of this paper it is a systematic classification of competences into hierarchical groups where each sublevel constitutes a breakdown of the higher level. Although a vast amount of research has been done in project management competences, there is no standard set of project management competences used (Nijhuis, 2012). Important reasons for constructing a taxonomy for project management competences are found in comparing previous research and in identifying key fields for project management education in higher education.

First a definition of competence is given, secondly the rationale of this research is given by discussing recent research. Several different published taxonomies of competences are reviewed. Finally a proposed taxonomy for project management competences is presented.

Definition of competence

Competence was once a simple term, but the concept has developed, making a framework necessary to provide a basis for identifying and measuring aspects of competence (Crawford, 2005). The integrate model of Crawford dissects competence into three types: input, personal and output. Input competences is the knowledge and understanding, skills and abilities that a person brings to a job, which has two pillars: knowledge and skills. Personal competencies are the core personality characteristics underlying a person's capability to do a job. Output competences is the ability to perform the activities within an occupational area to the levels of

performance expected in employment. This model is illustrated in figure 1.

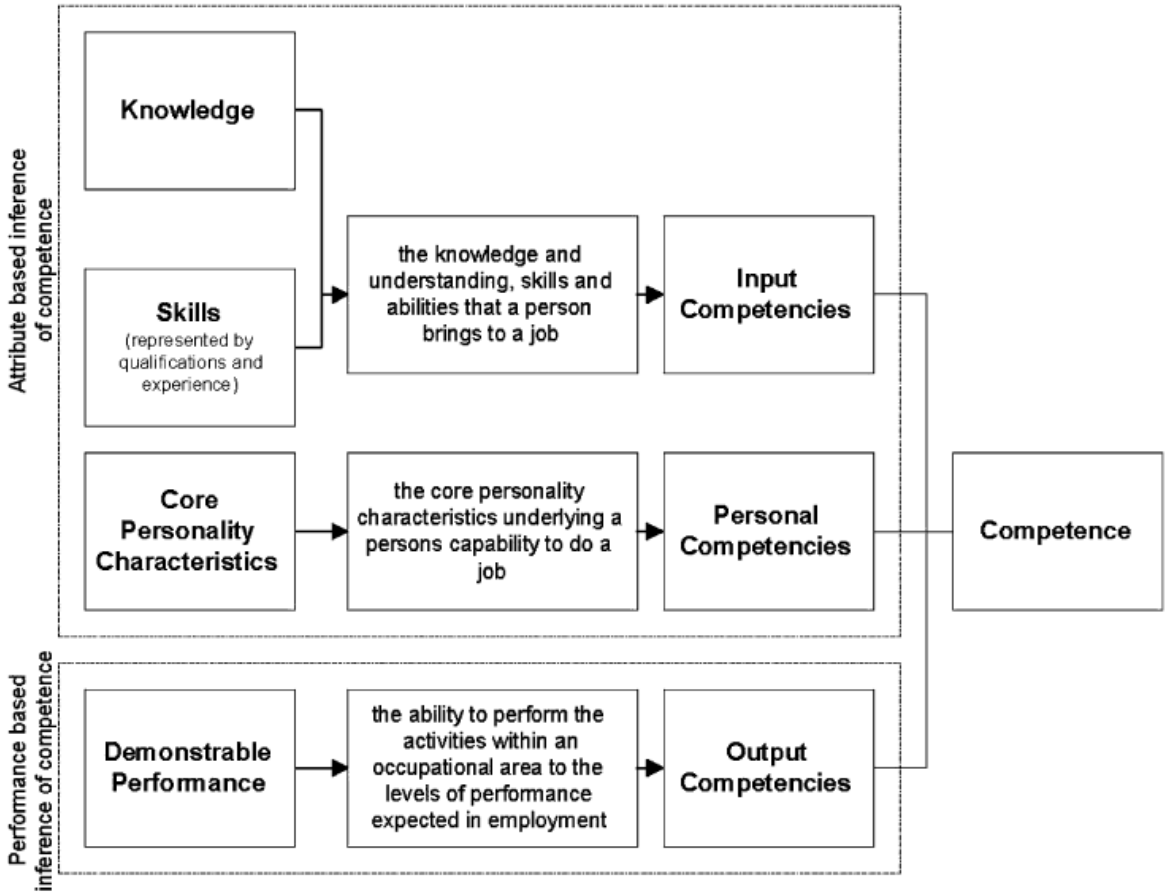

Figure 1. Integrated model of competence (Crawford, 2005)

For the purpose of this article, this model of competence is fitting. It allows the classification of other definitions of competence used. Only the input competence has two different classes of competences underlying the construct, Skills and Knowledge, these will be referred to as 'basic level competence'. The holistic view of competence, comprising of input, personal and output competence will be referred to as 'holistic competence'. The model is a taxonomy in itself, competences are classified into different sort of (sub)competences.

Recent research on project management competences

Project management is sometimes presented as something a proverbial monkey can do, as long as he uses the correct tools and techniques, the project will be a success. And if the project manager masters these tools and techniques, he can make any project in any situation or domain a success. This greatly undervalues the importance of a competent project manager, in contrast with the general management literature that shows that the manager's competence makes a direct contribution to the success of the organization (Turner & Müller, 2006). Lately many researchers in project management have published findings on project managers competence. A short semi-chronologic overview of recent publications, published after 2000, is presented.

Concluding that a validated survey instrument did not exist, Golob constructed a survey instrument to research how project management competences could be implemented in the workplace (Golob, 2002). His dissertation is based on an instrument with 35 competences and

provides a list of which competences are more or less important according to the respondents (mostly project managers and managers of project managers).

In 2005 the views of senior management on project management was published, sixteen competences, ranked in order of importance are presented (Crawford, 2005). In the same year, three dissertations were published on project management competences: Project leadership: An empirical investigation (Krahn, 2005), Critical factors in hiring, promoting and designing job descriptions for strategic project managers (Rodriguez, 2005) and A success paradigm for project managers in the aerospace industry (Bauer, 2005). Rodrigues built on the list of Golob, but deleted almost half and added a few new ones. Krahn used almost fifty competences while Bauer used seven.
Another publication tried to shed more light on the competence of the project manager: Project Management Education and Training Process for Career Development (Fisher, Schluter, & Toleti, 2005), in which a top ten is presented.

Two publications used almost the same foundation: Three conceptual levels of construction project management work (Chen & Partington, 2006) and Conceptual determinants of construction project management competence: A Chinese perspective (Chen, Partington, & Wang, 2008). Both used seven key attributes (or competence), in the second publication one is replaced. In 2006 yet another article on competences is published: The Competencies and Characteristics Required of an Effective Project Manager: A Web-Based Delphi Study (Brill, Bishop, & Walker, 2006). The study used nine categories to classify 78 competences.

In the meantime two master thesis were presented: A project manager's personal attributes as predictors for success (Valencia, 2007) and Analysis of current and desired project management competences in the building industry[1] (Everts, 2008). The first asked project manager to rate themselves, and their superiors to assess these project managers. Everts got responses of over hundred project managers. Considerably more than used for the dissertation 'Understanding the project manager competencies in a diversified project management community using a project management competency value grid' (McHenry, 2008), published in the same year.

In 2009 the IT business project management competence got attention in two articles: IT project managers' construction of successful project management practice: a repertory grid investigation (Napier, Keil, & Tan, 2009) and Rethinking IT project management: Evidence of a new mindset and its implications (Sauer & Reich, 2009). Although both focused on the same domain, there is no easy resemblance between their findings.

Although not published in a scientific journal or as thesis, the Project Benchmark Report of Arras people in 2010 is noteworthy because of their large number of respondents: approximately thousand (Arras People & Thorpe, 2010). They used thirteen competences which are ranked by program managers, change managers, project managers and project support personnel.

Of an even more recent date are Learning and teaching challenges in project management (Ojiako, Ashleigh, Chipulu, & Maguire, 2011), Using "Behavioral Profiling" to Identify "Successful" Project Managers (Giammalvo, 2012) and PMP® Certification as a Core

[1] translated title.

Competency: Necessary But Not Sufficient (Starkweather & Stevenson, 2011). Again the competences used in these studies vary.

It is noted that these studies vary in their purpose, so a difference in research base and findings is natural. All the mentioned characteristics, competences and attributes satisfy the definition of competence used in this paper. The publications mentioned here - 17 in total - have an average of 16,4 competence (using the nine categories of Brill as competence instead of the 78 more specific competences), or a total of 279. Of these competences twenty-two are mentioned twice, one is in three publications (problem solving) and one in four publications (leadership), leaving 251 unique competences. Of which less than nine percent is named in more than two publications. Two-thirds can be accounted to just one publication: Rodriguez using part of the original list of Golob. In total 27 different instances of competences are identified that share a link with communication. The congruence can be improved by grouping competences that seem to be identical, like communication, communication skill and ability to communicate. But in the definition of competence used here, communication could be interpreted as the holistic competence, ability to communicate could be interpreted as the output competence and communication skill as a basic level input competence.

A list of 251 (somewhat) different competences sounds quite encompassing, but it is not. Environmental concerns or sustainability are not mentioned. Governance does not appear on the list as well.

Use of general performance measures can obscure potentially important distinctions in how selected traits are related to work behavior. This may especially be likely to occur in managerial settings, where trait relevant task, group and organizational demands are diverse and complicated (Tett, Guterman, Bleier, & Murphy, 2000). With the addition that in project management these demands could even be contradictory, the same holds true for project management.

The absence of a taxonomy makes the research findings difficult to compare. It is hard to interpret whether they support or challenge each other. Without a taxonomy new research in the field of competences for project management will probably add to the fragmentation. The rigor of competences researched is hard to test. Has governance not been found important (yet), or was this not included in the research? If a taxonomy is present and used, shifts in desired competences could be made visible on all taxonomy levels.

The room in the curricula for incorporating project management competences in higher education is limited (Ellis, Thorpe, & Wood, 2003). Brill identified 78 trainable competences, of which 42 were found important to extremely important (Brill, Bishop, & Walker, 2006). A taxonomy will be useful to emphasize fields of importance for teaching project management in higher education, in order to identify key challenges. Like in management research, specificity offered by a taxonomy would help meeting research challenges (Tett, Guterman, Bleier, & Murphy, 2000).

Few researchers use project management standards as the basis for their research, although AIPM has published project management competency standards since the early 1990's (https://www.aipm.com.au). Most standards don't have a solid base in research (Crawford, 2004) and are created with certification in mind rather than being created for research purposes. For the purpose of classification, most standards do not provide a useful scaffold, leaving ample room for interpretation where to classify competences mentioned in research.

Taxonomies of competences

A taxonomy is a hierarchal arrangement of an interrelated group of definitions or processes (Satava, Gallagher, & Pellegrini, 2003), it can be used to classify things, organisms or competences. Satava et al. use a taxonomy to classify the level of performance in a competence (ranging from novice, through proficient, competent and expert to master).

In Health Education a recent publication strived to come to a common taxonomy of competency to provide a single, relevant infrastructure for curricular resources (Englander R, Cameron T, Ballard AJ, Dodge J, Bull J,Aschenbrener CA, 2013). Building on the work of the Accreditation Council for Graduate Medical Educations the original list of six domains with 36 competences was expanded to eight domains with 58 competences. Their work resulted in a taxonomy of two layers: the top layer consisted of eight domains with in total 58 competences in the second layer. These eight domains are: Patient Care, Knowledge for Practice, Practice-Based Learning and Improvement, Interpersonal and Communication Skills, Professionalism, Systems-Based Practice, Interprofessional Collaboration and Personal and Professional Development. The resulting classification appears unsuited for the purpose of constructing a taxonomy of project management competences, because of a lack of similarity.

Research of management competences could provide a better fit, because of the apparent overlap between management and project management (a.o. D Anderson, 1992).

A recognized work on taxonomies for competences is the "Development and Content Validation of a 'Hyperdimensional' Taxonomy of Managerial Competence" (Tett, Guterman, Bleier, & Murphy, 2000), which has been cited numerous times since publication[2]. They identified twelve previously published taxonomies and supplied two reasons why these were not sufficient. The first reason was no one model was clearly superior to another in aspects like method, population, purpose, content, complexity and comprehensiveness. The focus of the previous models on identifying general dimensions of performance used the models to reduce data, while the Tett et al. felt it necessary to dissect some of the more broader dimensions into smaller parts. Having reached this conclusion the researchers created a first draft containing 47 competences, based on the twelve previously published taxonomies (containing 109 dimensions). The draft was validated using two studies. This resulted in adding six new competences. The resulting list of 53 competences was evaluated in a third study. This rigorous approach yielded a taxonomy of 10 domains, containing 53 competences (see table 1 for an overview, both columns on the left). They concluded that the resulting taxonomy had a high level of specificity, expert judges were able to classify behavioral elements into targeted categories with considerable agreement and accuracy.

While Tett et al. defined competence as future evaluated work behavior, Shrivastava introduced a fractal and open system approach to competence and defined it as 'the ability *of a system* to create value in an optimal manner' (Shrivastava, 2008). Every competence uses input and transforms this input to produce output which in turn serves as input for another competence. The input part of the competence is described as the ability to bring to bear the resources needed for a given task. The transformation part of the competence is the ability to convert available resources into desirable outputs. The output part of the competence is the ability to retain and/or add value while delivering a finished product to the external environment. Shrivastava defined three clusters of competency: interface, growth and

[2] 52 times according to the publisher and 205 times according to Google Scholar, retrieved January 29th 2014

contingency with fourteen ITO-competences and acknowledges that there is an slight overlap between those clusters. See table 2 for an overview (both columns on the left).

Even more recently a comparative study of effective an ineffective managerial behavior was published (Patel & Hamlin, 2012). They deduced a taxonomy of perceived managerial and leadership effectiveness, consisting of two groups: effective and ineffective behavior. Behavior mentioned in the effective group is usually also found - mirrored - in the ineffective group, making this taxonomy unsuited for the purpose of this paper.

Of the taxonomies discussed, the hyperdimensional (Tett, Guterman, Bleier, & Murphy, 2000) and the open systems approach (Shrivastava, 2008) appear to be suited as a basis for constructing a taxonomy for project management competences.

Domain	Competences	Suggested additions
Traditional functions	1. Problem Awareness 2. Decision Making 3. Directing 4. Decision Delegation 5. Short-Term Planning 6. Strategic Planning 7. Coordination 8. Goal Setting 9. Monitoring 10. Motivating by Authority 11. Motivating by Persuasion 12. Team Building 13. Productivity	Conflict handling Influencing Leadership Problem solving Risk management
Task Orientation	14. Initiative 15. Task Focus 16. Urgency 17. Decisiveness	
Person Orientation	18. Compassion 19. Cooperation 20. Sociability 21. Politeness 22. Political Astuteness 23. Assertiveness 24. Seeking Input 25. Customer Focus	
Dependability	26. Orderliness 27. Rule Orientation 28. Personal	
Responsibility	29. Trustworthiness 30. Timeliness 31. Professionalism 32. Loyalty	
Open Mindedness	33. Tolerance 34. Adaptability 35. Creative Thinking 36. Cultural Appreciation	Analytical thinking
Emotional Control	37. Resilience 38. Stress Management	
Communication	39. Listening Skills 40. Oral Communication 41. Public Presentation 42. Written Communication	Meetings
Developing Self and Others	43. Developmental Goal Setting 44. Performance Assessment 45. Developmental Feedback 46. Job Enrichment 47. Self Development	Coaching
Occupational Acumen and Concerns	48. Job Knowledge 49. Organizational Awareness 50. Quantity Concern 51. Quality Concern 52. Financial Concern 53. Safety Concern	Contract management Expectation management Negotiating

Table 1. Hyperdimensional Taxonomy (Tett, Guterman, Bleier, & Murphy, 2000) with suggested additions for project management.

Cluster & definition	Competences	Suggested additions
1. Interface Competences that ensure transfer of resources between and amongst systems in as seamless and frictionless a manner as possible.	1. Work Process Designing Skills 2. Negotiation and Conflict Resolution Skills 3. Team Building Skills 4. Time Management Skills 5. Emotional Intelligence	
2. Growth Competences that enable to continually gauge the quality of value created so as to make changes when necessary and take the system in question to a higher plane by offering superior value.	6. Goal Setting Skills 7. Organization & Industry Knowledge 8. Motivational Skills 9. Self and Subordinate Development Skills 10. Performance Assessment Skills	
3. Contingency Competences that enable to stabilize a system during a crisis and, if needed, turn it around so that the system in question can attain a new state of equilibrium in a different environment.	11. Visioning Skills 12. Decision Making Skills 13. Emotional Stability 14. Problem Solving Skills	Leadership Initiative

Table 2. Open systems taxonomy (Shrivastava, 2008) with suggested additions for project management.

Comparing

To test both taxonomies, a comparison is made between the 279 competences of recent research (referred to as R-competences) and the taxonomies. Of the 279 competences of recent research a high percentage of them can be assigned to clusters/domains or specific competences of both taxonomies: 268 (96%) in the hyperdimensional and 265 (95%) in the open systems, which is very promising that at least one of them could be used as a taxonomy for project management competences.

R-competences that could not be assigned to a domain/cluster or taxonomy competence are either previous work experience related, very abstract (intelligence, personal characteristics) and/or combination competences, albeit that the list of 'non-assignable R-competences' is not exactly the same for both taxonomies.
Interesting is the group of R-competences that could not be assigned to a taxonomy competence (T-competence), but could be assigned to a T-domain (hyperdimensional) or T-cluster (open system). Assigning R-competences to T-competences favors the open system approach (208 versus 159), which is to be expected due to the higher specificity of the hyperdimensional taxonomy.

Underlying reasons why R-competences could not be assigned to a T-competence vary mostly between 'overall competence', 'multiple competence' or ´fitting T-competence is missing'. An example of overall is communication (assigned to 'Communication' in the hyperdimensional and 'Interface' in the open systems[3]). An example of multiple is report which could be written and oral communication. An example of 'missing' is 'conflict handling' in traditional functions of the hyperdimensional taxonomy. In the hyperdimensional taxonomy the comparison suggests an addition of 11 T-competences and in the open systems taxonomy only 2. See tables 3 and 4 right hand column for details.

[3] An argument could be made that communication would be overall for the open systems taxonomy. For the purpose of this paper a high specificity has been pursued.

Especially the last category will be a source of discussion. Since the purpose of this paper is to identify a taxonomy that could help compare previous research and identify key fields for project management education (in higher education), the attention of the discussion is focused with this argument in mind.

Discussion

It would seem that the comparison favors the open systems taxonomy: More R-competences can be assigned to T-competences and less addition of T-competences needed in the taxonomy to accommodate for project management. But these numbers don't show the specificity the hypertaxonomy has. And it is this specificity that makes this taxonomy favorable: for designing research, comparing research and for identifying key challenges specificity is an asset. Examples are the high number of R-competences that are linked to communication (27 in total). In the hyperdimensional they are linked to an own domain and specified in 4 (+ 1) T-competences. In the open systems taxonomy they are linked to a cluster (although one can argue that they are linked to all clusters), but not specified. This makes it hard to compare research. An higher specificity would likewise help to identify key challenges.

Conclusions and further research

Two taxonomies appear to be fitting to be used in an augmented form for classifying project management competences: the hyperdimensional taxonomy (Tett, Guterman, Bleier, & Murphy, 2000) and the open systems taxonomy (Shrivastava, 2008). Comparison between recent research on project management competences favors the opens systems taxonomy on numbers. But the specificity of the hyperdimensional taxonomy shows a better fit for the purpose of this paper: comparing research and identifying key challenges for education.

Further research needs to be done. This is a first step into creating a taxonomy for project management competences, based on the comparison of recent research and two taxonomies for management competences. Further analysis of learning outcomes of project management courses and curricula and of project management standards should provide a more solid base for a choice between them.

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