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Projects, success, and complexity

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Synopsis

All projects need an understanding of success. Without one, any project outcome would do. Measures of success are needed for the fundamental navigation of projects. Projects have notoriously struggled with the definition of success. One main reason for measuring success is to understand how to do things better the next time. Therefore, the success of a given project needs to be seen in relation to how difficult the project was. Project complexity is a relevant measure of the difficulty of a given project. In other words, project success should be seen relative to the complexity of the project. This paper analyzes relationships between Project Success and Complexity using the Cynefin framework as a lens.

Relevance for practice/education

A better understanding of both project success and project complexity, and the application of this in a discussion of how to measure project efficiency and effectiveness in a relevant manner.

Research design

Literature review.

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Main findings

Project efficiency can be measured in relation to project complexity. Project complexity functions as a link between two kinds of project success: efficiency and effectiveness.

Research implications

Further study of the relations between project success and project complexity is needed.

Keywords

Project Success, Efficiency, Effectiveness, Project Complexity, Cynefin framework

Introduction

Do we need a wider understanding of project success? The answer depends on whether we want to validate, improve or compare the projects. Depending on which of these three purposes we are aiming for, the measures might be very different.

The answer also depends heavily on how we define a project. One definition is "*a temporary endeavour undertaken to create a unique product, service or result*" (PMI, 2013). The International Project Management Association (IPMA) research conference 2017, however, defines it differently: *Projects are the means for delivering and implementing beneficial strategic change in organizations and societies*. Two very divergent definitions.

The first definition is rather inward looking (based on what we can create), while the latter is more outward looking (how we can benefit organization and societies). One reflection is that this might underlie a shift, where we are going from an introverted to an extroverted way of managing projects. Is the second better than the first? This is very much dependent on stakeholders' expectations of the specific project.

Researching the success of projects has an extensive history, as illustrated by a paper from NASA: "*While many determinants of project mission success were identified, a somewhat unsettling finding was that effective cost performance was not uniformly associated with mission success. In fact, the data revealed that mission-successful projects more often than not show a cost overrun, often a very substantial one*" (Murphy et al. 1974).

More unsettling might be that the very construct of "mission success" can be questioned: *In summary, labelling a project outcome as a "success" or "failure" is convenient but overly simplistic. A degree of conceptual and definitional ambiguity surrounds project success. Further, evaluations of project success are necessarily perceptual and (inter)subjectively constructed* (McLeod et al. 2012).

However, even accounting for the concept that evaluations are perceptual and subjectively constructed, we must assume that the evaluation process is better off with measures of project success than without them. One measure could be Key Performance Indicators (KPIs). *By measuring project success according to the defined KPIs, we can achieve a more comprehensive evaluation of the project* (Todorovic 2015).

KPIs, as mentioned by Todrovic, are synonymous with success criteria, namely the measurement of the purpose of the project, often formulated at the beginning of a project. This should provide a sound foundation for the evaluation of project success; however, *"In contrast, our study demonstrates that success criteria – which are formulated and agreed upon at the start of a project – are hardly objective and change as the project progresses through various phases.*

The perceived success also depends on the perspective of various stakeholders and project roles, and thus indeed lies in the 'eye of the beholder'" (Neves et al. 2017). Evaluations of project success can be a subjective and social construction, based on ambiguous definitions and constantly changing with time.

In addition to this, it is relevant to investigate the relationship with project complexity, since a study shows a "*… strong relationship between project complexity and project success is augmented by the standardized coefficient value of –0.254 between them.*" (Lou et al 2016). Among the many parameters investigated the most significant in this study was: "*Trust among project organization*" and "*Sense of cooperation*" in this study. (Lou et al 2016).

There are clearly interesting relationships between concepts of project complexity and project success, worth more investigations. To widen the perspective, this paper, therefore, asks: How can we use project complexity to widen our understanding of project success?

The remaining paper is structured as follows. In the first section, the method is described, followed by the findings in the next section. Then a discussion sector is followed by a conclusion and further research suggestions.

Method

The research question is answered by a literature review followed by a comprehensive discussion on project success and complexity based on various project management methodologies.

SEARCH AND SELECTION

The first stage of the literature review was an explorative search that attempted to distinguish patterns in the newest papers, followed by a structured process, with clear selection criteria and evaluation methods.

The explorative search revealed that the search strings 'definition of project success' and 'definition of project complexity' would offer a coherent set of publications upon which to base the review of 'understanding.' The selection was limited to five years, starting with 2012. The search on project complexity returned 74 titles on Google Scholar, and 494 titles for project success. From these, 20 were selected, including the ten newest plus the ten most quoted in the available publications. This method does not provide an exhaustive list of the potential findings, but it is of sufficient significance to offer sound conclusions. The papers were searched for clearly articulated definitions, and if none were found, the paper was excluded.

A THEORETICAL LENS

For the purposes of discussion, the Cynefin Framework is used as a theoretical lens. This is a sense-making framework intended for strategy work (Snowden 2007). Recently, the Cynefin framework has gained attention in papers on project complexity. By using this framework, the paper will reach beyond the usual boundaries of the project domain, as requested in the call for papers.

The framework consists of five domains, see Figure 1. On the right side, there are two ordered domains; complicated and obvious. On the left are two un-ordered, complex and chaotic. The fifth domain is the red area in the middle, called disorder, where you are if you do not know what type of system you are dealing with.

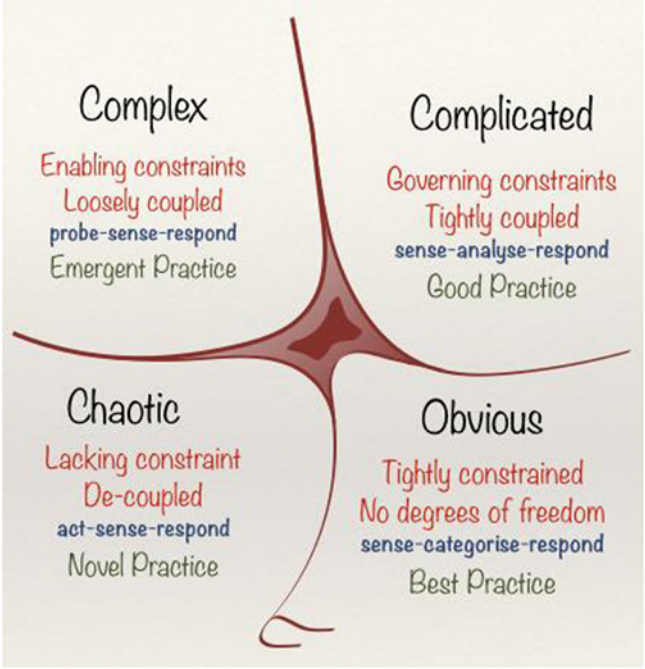

Figure 1 Cynefin Framework. Source: www.cognitive-edge.com

The four domains:

1. In the obvious domain, the systems have cause and effect, that are obvious to all, and there is a best practice to follow. Originally the obvious was called simple, but this was changed in the later version of Cynefin Framework.
2. In complicated scenario, there are also direct connections between cause and effect, but further analysis is needed. More options are available, hence good practice is recommended rather than an all embracing best practice being available.
3. In complex systems, the cause and effect can only be seen in hindsight. This gives emergent practice.
4. In a chaotic system, everything is random according to Cynefin framework's use of the term. Here, we have novel practice in the sense that no two situations are alike.

Findings

The findings are divided into:

1. Findings concerning the definition of project success, and
2. Findings concerning definitions of project complexity.

PROJECT SUCCESS

Among the 20 selected, seven had explicit definitions of project success. These are displayed in Table 1.

Column A describes the part of project success concerned with the triple constraints, scope, budget, and deadline. This covers process success, project efficiency, project process, project efficiency, tactical performance, efficiency dimension. These terms can be consolidated in the term: project efficiency. Only one of the seven did not mention project efficiency. One added safety and cash-flow to the triple constraints. There is a commonly accepted content of the term project efficiency.

Table 1 Seven definitions of project success

Author, year	Quotes on definitions of project success			
	Column A	Column B		
McLeod et al.2012	*Process success. (project management) On time, within budget to scope / specifications*	*Product Success (project objectives) Product use, Client satisfaction, Client benefits*	*Organizational Success (organization's objectives) Business benefits Strategic benefits*	
Mir & Pinnington 2013	*Project Efficiency meeting schedule and budget goals*	*Impact on customer customer benefits in performance of end products and meeting customer needs*	*Business Success project benefits in commercial value and market share*	*Prepare for the future, creating new technological and operational infrastructure and market opportunities.*
Howsawi et al 2014	*Project process: This level contains the criteria used to judge the actions taken to provide the required deliverables. Examples of such criteria are meeting budget and schedule, and efficiency of execution.*	*Products and deliverables: This level contains the criteria used to judge the technical requirements and qualities of the products or deliverables resulting from the project. Examples of such criteria are technical validity, manufacturability, and technical performance.*	*Business: This level contains the criteria used to judge the benefits and returns (or losses) of the project to the stakeholders. Examples of such criteria are the contribution of the project to the strategic mission of the firm, preparing for the future, and satisfying the needs of the users.*	*Context and externalities: This level contains the criteria used to judge the project based on compliance with the contextual circumstances and externalities that affect it, such as the political situation, regime, and climate. The project team or organization has little or no control over these externalities.*
Serrador, & Pinto 2015	*Project efficiency: meeting cost, time and scope goals*	*Stakeholder success: satisfying the expectations of project stakeholders, who are the best judges of overall success*		n/a

Table 1 continued

Samset & Volden 2015	*Tactical performance cost, time, quality*	n/a	*Strategic performance relevance, effectiveness, Sustainability*
Silva 2016	*Efficiency dimension cost, time, quality, safety, cash-flow*	*Effectiveness dimension environment performance, client satisfaction, employee satisfaction, probability, learning and development*	
Joslin & Müller 2015	*Project success is a multidimensional construct where project stakeholders can select a number of project success criteria they believe are important to judge on success*		

The content of column B is more diversified than the content of column A. In column B is mentioned such terms as product, organization, business, impact on customer, benefits, prepare for the future, context, sustainability, stakeholder satisfaction, strategy, and effectiveness. The dimensions under column B are much less homogeneous than column A, but in order to have one term covering the lot, the term is chosen to be effectiveness.

The choice of efficiency and effectiveness as a dichotomy, explaining project success, is at the same time an acknowledgement to the quote often attributed to Peter Drucker: "*Efficiency is doing things right; effectiveness is doing the right things*."

PROJECT COMPLEXITY

The search for a definition of project complexity revealed that there is no commonly accepted definition to be found. More than half the papers offered statements similar to the three examples given below:

- *However, there still was no commonly accepted definition of project complexity, despite a large number proposed. Each author had a different perspective on defining project complexity* (Dao 2016).
- *Project complexity as a concept is often used but also rarely understood, many different definitions and interpretations are available resulting in difficulties when discussing the topic* (Swinkels 2016).
- *Despite the many existing studies on project complexity, there is no universal agreement on the definition of project complexity* (Zhu et al. 2016).

Because of this, there is no table to compare definitions of project complexity in the way in which Table 1 documents project success.

Instead, we follow the reference back, to obtain a brief historical overview.

Brief historical overview

Most sources agree that the starting point is: *It is proposed that project complexity is defined as 'consisting of many varied interrelated parts' and can be operationalized in terms of differentiation and interdependency*. (Baccarini 1996).

Subsequently, the understanding of project complexity took many routes. To illustrate the variation, we have chosen: *Complex projects, like complex adaptive systems, are characterized by high levels of Uncertainty, Ambiguity, Decreasing levels of trust. (Remington* 2009*).*

A systematic literature review was conducted in 2011. The conclusion was that project complexity has evolved to encompass five dimensions: S*tructural complexity, Uncertainty, Dynamic, Pace, and Socio-political.* (Geraldi et al. 2011).

A similar literature review performed five years later showed further development, and expanded the understanding to eight dimensions: *Structural complexity, Uncertainty, Emergence, Autonomy, Connectivity, Diversity, Socio-political, and Element of context*. (Bakhshi et al. 2016)

From the selected papers, the following dimensions can be added (non-exhaustive list); *stakeholder management, social, trust, product/service, quality, client, finance, legal, social, cultural, cognitive, operative, external and business environment.*

Many of the models/frameworks have the aim of creating assessment tools, such as the IPMA assessment tool for certification on Level B, which has 41 dimensions. (In Scandinavia, an assessment of 12 dimensions is used for all IPMA certificates). It is worth noting that, for some unknown reason, the IPMA assessment tool has not yet attracted the attention of researchers.

The chosen definition of project complexity

For this paper, we have selected a definition of project complexity which carries sufficient commonality to capture the heart of the scientific field. Furthermore, this is the only definition that is referred to in at least some of the other papers.

Project complexity is the property of a project which makes it difficult to understand, foresee and keep under control its overall behaviour, even when given reasonably complete information about the project system. Its drivers are factors related to project size, project variety, project interdependence. (Merle & Vidal 2016)

Discussion

Table 1 provides the impression that efficiency and effectiveness are separate. In practice, however, there is often a trade-off between efficiency and effectiveness. As an example, scope creep is often used to satisfy stakeholders, increasing effectiveness, but it costs in terms of reduced efficiency.

In a study measuring the gap between "true project management success" and "perceived project management success" (judged by the stakeholder), it was found that "expectations management" is the most significant factor to explain the "unjustified hurrah" (= stakeholders happy, but the iron triangle is not met). The second most important factor was "sponsor commitment." (Neves et al 2017)

In this study, like many others, the iron triangle carries an aura of objectivity. However, in practice, it is a tool for the management of expectations. It is the result of the initial negotiation of the project (Davis 2017), often carried out between the project manager and the sponsor, or between the salesperson and the client.

In spite of the connection between efficiency and effectiveness, the two dimensions will be handled separately.

PROJECT EFFICIENCY – WITH CYNEFIN FRAMEWORK AS A LENS

Looking at project efficiency (so-called project management success), through the Cynefin framework, we only use three out of the five domains: obvious, complicated and complex. Chaotic and disorder domains are not included since they are transitional phases (Snowden 2015). To nuance the discussion, two further levels are added: borderline complicated

and borderline complex. This provides more fine-grained levels of complexity in which to investigate project efficiency, since we have five levels instead of only three if we did not use the borderline complexity levels.

Obvious: When cause and effect are obvious, we know in advance what is needed. One might argue that this might not even be projects, since the newness might be too small. However, in such cases, the project model can be: *"Just Do It!" In this reactive mindset, schedule and budget dominate the measures of project success* (Poli er al.2003). The project's lifecycle might be a simple waterfall model, as this is the best practice for this kind of project. As illustrated in the Cynefin framework, the constraints are rigid. If the projects are done properly, by applying best practice that have been developed by repetitions of many similar projects, we can expect a 100% success rate in terms of efficiency for this kind of projects. If not, we can blame "best practice".

Borderline complicated: Projects are not quite as obvious at this level. Cause and effect are clear, but some kind of analysis is needed. Not all aspects are 100% known, and therefore we can expect changes to the iron triangle as we go along with the project. This calls for change control (PMI 2013, section 4.5). Change Control gives the project's decision-makers the opportunity to keep stakeholders satisfied even when new needs and ideas emerge during the product's lifecycle. A project governed by change control is on the borderline between obvious and complicated. The final iron triangle will be different from the initial triangle; a simple calculation of efficiency based on the initial triple constraints can therefore never reach 100%.

Complicated: If the uncertainty is too extensive to be handled by simple change control, a stage-gate model will be more suitable than the waterfall model. A stage-gate model can divide the project execution into several stages, each separated by a gate, where the direction for the next stage is re-evaluated and committed. We have, what is called "governing constraints" in the Cynefin Framework. In PRINCE2, this is called "control stage," followed by "giving direction" (Axelon 2009).

Borderline complex: The prerequisite of the above complicated model is that the content can be analyzed beforehand. If this is not possible, an agile project model will be more appropriate to use. Planning the entire project does not make sense. Instead, we can apply an agile project methodology, for instance, PRINCE2 agile. The so-called Agile–Stage-Gate Hybrids are *"adding elements of Agile to traditional Stage-Gate structures to add flexibility and speed while retaining structure"* (Cooper 2016).

Even though Scrum (Sutherland 2014) is not a project management methodology, it can here be used to illustrate the borderline complex situation. *Scrum is a "complex" to "complicated" transition device* (Snowden 2015). The prioritization of the backlog items is in the complex domain. The sprint planning will be in the complicated domain, and the sprint itself might be in the obvious domain with ridged constraints because all sprint items must be performed before the end of the sprint (Sutherland & Sutherland 2014).

Complex: Cause and effect can only be seen in hindsight. The constraints are applied to make something happen, for example, a deadline for an experiment – or a budget to be used on a hypothesis. Frequently, the project will only exist in the complex domain, in the beginning, the fluffy front end of innovation. The PMagile has a phase designed specifically to handle this kind of complexity, called the foundation phase (APMG 2014). Snowden recommends the use of parallel "safe-to-fail-experiments" (Snowden 2015). The point is not only that it is safe to fail, but also the speed of development, because of them being parallel – compared to the serial sprints in Scrum or the serial timeboxes in PM agile and PRINCE2agile.

To sum up, the levels are displayed in Table 2.

Table 2 The five levels of project complexity matched with a suitable PM method and relevant measures of project management success.

Level of project complexity based on Cynefin framework	Project management methods for coping with the complexity	Relevant measuring of project management success (efficiency)
Obvious - rigid constraints	"just do it" / simple waterfall	Measure against initial triple constraints relevant
Borderline complicated	Waterfall with change control	Measure against final triple constraints relevant (but not the initial version)
Complicated - governing constraints	Stage-gate model, such as PRINCE2.	Measured stage by stage; final triple constraints for the stage – not for the project
Borderline complex	PRINCE2 agile or PM agile (or Scrum)	Measure against the deadline and the budget (Scope is flexible, and therefore not a relevant measure)
Complex - Enabling constraints	PM agile, safe-to-fail-experiments, and suchlike	Measure against either the deadline or the budget

PROJECT EFFECTIVENESS – STAKEHOLDERS' EXPECTATIONS FOR THE PROJECT

Based on McLeod's definition of project success, the project effectiveness can be divided into five elements: product use, client satisfaction, client benefits, business benefits and strategic benefits.

With the Cynefin framework as a lens, seen from the perspective of the project, the realization of the client and bBusiness benefits are complex, because agents operate without constraints. (Since behaviour is not random, but under some influence from the project, it is "only" complex, not chaotic). However, realizing the strategic benefits may seem random from the project's perspective, and therefore in the chaotic domain. Product use and client satisfaction are more predictable in terms of cause and effect from the project's perspective, and are therefore in the complicated, but probably never in the obvious, domain.

Project effectiveness can be seen as a struggle between the project – a temporal organization – and the permanent organization/the client organization. One question is:

> Do the stakeholders of a given project expect the project to
>
> A) "*create a unique product, service or result*" or do they expect
>
> B) "*delivering and implementing beneficial strategic change in organizations and societies*?" (With reference to the definitions from PMI versus IPMA research in the introduction).

Project expectation A will – all things being equal – result in a lower project complexity than B. This follows from the fact that B is both delivering and implementation, where A is only delivering (i.e., creating) the product, service or result. There will be higher uncertainty, more socio-political aspects, interaction with a business environment, etc. (from the list

of dimensions mentioned under "definitions of project complexity"). In other words, the stakeholders' expectations influence the level of project complexity.

Project Complexity is a consequence of decisions made in the organization owning the project. The borders of a project are not given by nature, but by decisions in and around the project. Each of the dimensions listed under Project Definitions will be the result of decisions on how to set up, organize and run the project. Furthermore, we can expect that: "*Complexity does not remain constant over the lifespan of the project… In the end, the aim is to reduce it by decision-making*" (Brockmann & Kähkönen 2012).

One central decision is should the project stand alone and be evaluated on its own merits against the effectiveness measures? Organizations could instead improve the Benefits Management (Badewi 2016), which will reduce complexity for the project since a complex part herby is moved out of the project and placed with the benefits manager.

Another decision could be to place the project in a program. Managing successful programmes (MSP, see Figure 2) describes the cause and effect process from project to corporate objectives, namely project outputs lead to capabilities in the organization, which create outcomes that lead to benefits. (Axelos MSP 2011)

Figure 2 Process based on MSP

The responsibility of a program, defined by MSP, is almost equal to the five elements of effectiveness mentioned above. With a program, the measure "project effectiveness" would, however, be almost obsolete, and substituted with measures of "program success."

Inside a program, the project can focus on delivering the agreed upon output; thus, many of the dimensions of project complexity will give a lower score, making the project less *difficult to understand, foresee and keep under control* (definition from Merle and Vidal), thus lowering the project's complexity.

We have hereby demonstrated how the introduction of a program and/or use of a benefits manager will reduce the complexity of the project. The introduction of a program and/or use of a benefits manager is equivalent to lowering the stakeholder expectation of effectiveness of the project.

SUMMING UP THE DISCUSSION:

We have shown how increasing levels of project complexity reduce the relevance of measuring project efficiency by triple constraints. Furthermore, we have shown how stakeholders' focus on project effectiveness leads to increasing complexity. These two statements compounded are illustrated in Figure 3, where we have used the three complexity domains from Cynefin framework to illustrate increasing project complexity.

When a project is forced to focus on effectiveness (see Table 1), there is an increase in one or more of the dimensions of project complexity. Therefore, the level of project complexity increases. When project complexity increases, the project efficiency becomes less relevant as a measure of project success (See Table 2).

Figure 3: Illustration of how project complexity can serve as an explanatory link between project effectiveness and Efficiency.

The more stakeholders expect effectiveness (the independent variable), the more the project becomes complex, which leads to the lower relevance of the project efficiency measure based on the triple constraints (The dependent variable).

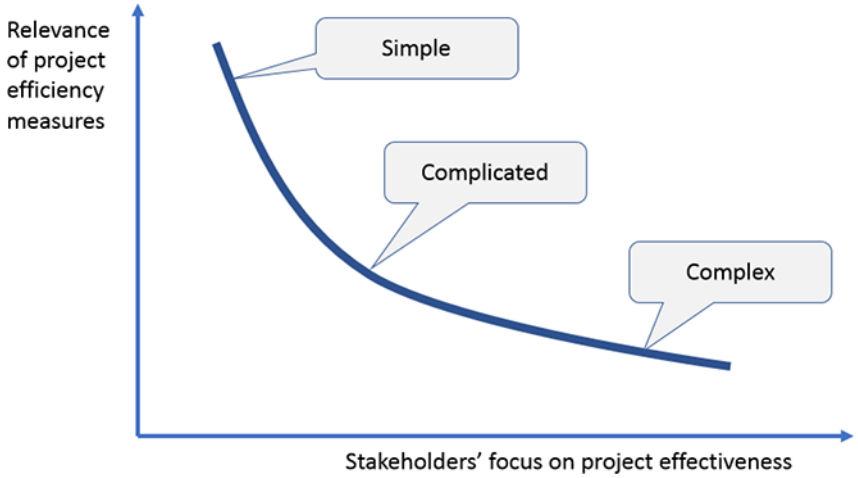

Figure 3 Relationship between project effectiveness and efficiency

The relationship shown in Figure 3 is interesting because we now have an indication of the correlation of focus on effectiveness and the relevance of efficiency as a measure of success.

Conclusion and further research

The common definition of project success often consists of:

1. The project efficiency, based on the triple constraints, and
2. The project effectiveness, which can be divided into the product/client dimension and the organizational dimension.

There is no commonly accepted definition of project complexity. Given that the field is more than two decades old, it is relevant to research why there are no commonly accepted definitions. Moreover, many different models of project complexity exist based on dimensions similar to the IPMA assessment tool exist, which ought to be further researched.

By using the Cynefin Framework (a complexity theory based model for strategy work) as a lens, the paper has argued for dividing project efficiency (project management success) into five different measures.

Another topic of relevance for further research is that the Cynefin Framework also can be used to categorize the many different models and dimensions of project complexity.

Furthermore, the paper has argued that project complexity can be used as a description of the link between the two project success parameters: efficiency and effectiveness.

Based on this, it is relevant to consider the third definition of success, namely project complexity success, which can serve as a link between the project success and project management successes. There is a need for further research to explore the relationships between efficiency, effectiveness, and complexity. Based on the development of the definition of both project success and project complexity, further research might ask if coping with complexity is equal to achieving project success?

Further research is needed to make an evidence-based verification of the relationship between the focus on effectiveness and the project complexity and the relationship between the project complexity and the relevance of project efficiency measures.

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MSc Mogens Frank Mikkelsen has 15 years as practitioner of Project Management; is certified in PMP, IPMA, Prince2 and Scrum; he has worked 12 years as trainer and instructor in the field of Project Management; he has published many articles for practitioners in the journal of Danish Project Management Association as well as a handbook for practitioners in Danish "Ledelse af komplekse projekter", 2016 (title translate to: Leading complex projects). He has also published: "How to cope with complexity? - A review of project complexity literature using the Cynefin framework as theoretical lens", IRIS conference paper, 2016; and has enrolled in a PhD study at IT University of Copenhagen.