Abstract

Universities’ core project management courses address the key principles and best practices of project management methodologies, while elective courses are used to introduce alternative project frameworks. This paper proposes a preliminary framework for the development of an elective course on project complexity based on the Project Management Institute’s Navigating Complexity practice guide.

Keywords

Project complexity, project management, curriculum design, leadership, uncertainty, bias

Introduction

A key aspect of project success is the competency of the project manager, developed through education and on-the-job experience. Universities that offer degrees in project management seek to broaden the learning experience of their students through a variety of project management courses. While a typical core project curriculum introduces the principles of the project management methodology, it is through elective courses that instructors can expose students to alternative variables that impact the success of projects. As a result, an important question for instructors is how to design a challenging course elective in project management to build competencies. This paper attempts to answer this question by proposing a preliminary framework for an elective course on project complexity. It provides a set of topics and corresponding studies that can be used to develop project complexity curriculum for project management students. Learning outcomes for a course on project complexity can be focused on the examination of the concept of project complexity and related factors such as human behavior, stakeholder management, and leadership qualifications.

The rest of the paper is structured as follows. First, a brief overview of potential learning objectives is proposed. This is followed by a review of relevant complexity factors based on the Project Management Institute’s (PMI) Navigating Complexity practice guide. The paper concludes with review of additional factors not included in the framework.

Project Complexity

Instructors can begin with the introduction of complexity theory. Specifically, the focus can be on examining the concept of complex systems and how they are related to organizations. This will set a stage for students to differentiate between simple and complex systems and determine whether organizations are ready to deal with such complexities.

A paper that can be used to examine complexity is Baccarini (1996)’s study, which provides two definitions of complexity with projects: 1) consisting of many varied interrelated parts with a number of varied elements, e.g. tasks, specialists, and the degree of interrelatedness between these elements; 2) complicated, involved, intricate, where it is explained by the criticality of project, project visibility and accountability, and clarity of scope definition. Additionally, the study by Johns (2008) proposed several forms of complexity, which can help students integrate Baccarini’s concepts. These include: technical
complexity, environmental complexity, organizational complexity, social complexity, and value relativism complexity.

**Types and Drivers of Project Complexity**

After the definition of project complexity, the instructor can focus on the various types of project complexity as proposed by Shenhar and Dvir (2007): 1) assembly project complexity, which deals with a component or device within a larger system that perform a single function; 2) system project complexity - related to systems (such as computers), full platforms (cars, buildings), or business units; and finally 3) array project complexity - associated with systems that, while functioning together, are spread out geographically.

In addition to types, the instructor can introduce specific drivers of project complexity. One study that can be used to demonstrate these drivers was conducted by Bosch-Rekveldt et al. (2010). In it, the authors investigated the multiplicity of drivers of project complexity and proposed a comprehensive list of elements that contribute to varying degrees to project complexity. The critical ones to bring up to the students’ attention include: internal company politics, numerous project methodologies, interdepartmental dependencies, technology uncertainty, and variety of stakeholders.

**Human Behavior and the Stakeholder Role**

After examining project complexity, the instructor can focus on the impact of human behavior as a source of complexity. Human behavior in itself is a complex adaptive system and as a result, it is an ever evolving phenomena. It is dynamic and in most instances can be changed in ways to help reduce project complexity. As a result, a review of negative traits, such as delusion and deception, emotions role optimism, planning fallacy, and sunk cost bias can help students become aware of how such factors can lead to poor decision-making and ultimately project failures.

**Impact of Human Behavior**

According to PMI's Navigating Complexity practice guide, human behavior plays a pivotal role in the development of project complexity. The main source of complexity arises from the effect of both individual and group behaviors within the project system. The instructor can draw the students’ attention to: unrealistic individual expectations, lack of goal clarity, and hidden individual agendas. In addition, the practice guide introduces several key individual behaviors as a source of complexity. These include: framing effect – the skewing of perception as a result of the manner of presentation of information and who presents such information; sunk cost effect – the refusal to abandon a failing project due to the amount of emotion, energy and resources already invested in it; and resistance – the refusal to embrace change and to adapt to the changing environment. Each of these factors can be examined in greater detailed during the course to further augment students’ understanding on the role of human behavior with respect to project complexity.

**Role of Delusion and Deception**

According to Flyvbjerg et al. (2009), delusion is the act of executives falling victims to decision-making based on delusional optimism rather than on rational evaluation of existing options. The instructor can address this concept in relation to the inside view perspective where executives make decisions on the assumption that the project on hand represents a unique occurrence.

Anchoring is another consequence of the delusion phenomenon and is important to be reviewed because this bias occurs when executives tend to lock their perception of project assumptions and estimates on the basis of poor information acquired earlier in the project.

Another driver of complexity in the same paper is deception - planning inaccuracies with regards to politics and agency issues. One of the sources of deception is self-interest - the idea that executives make decisions during the business case process that will help them increase the size, influence, and incentives of their projects. In line with this factor, the authors introduce ‘the asymmetric information source,’ which suggests that the project champions have access to additional data that the project principals do not. As a
result of this additional information disparity, principals, who are the key decision makers, are easier to deceive and end up making the wrong decisions as a result of this deception.

**Over-Optimistic Decision Making**

When it comes to over-optimistic decision making, the instructor can offer the paper by Lovallo and Kahneman (2003) to illustrate the following traits that lead to such practices: 1) decision makers on projects often tend to exaggerate their personal talents and tend to misperceive potential causes of events by taking credit for unrelated positive occurrences, and placing blame for negative outcomes on external factors; 2) decision makers tend to exaggerate the degree of control over specific events, rather than taking into account the role of chance; 3) principals focus on their own projects, while neglecting potential abilities and actions of rivals that could impact the project success; and finally, 4) project principals also tend to provide overoptimistic forecasts in order to win project approval.

**Biases**

To examine biases that drive project complexity, the instructor can use the study by Dilts and Pence (2005) to examine the role of decision makers (executive or project manager) on a project. The researchers discussed the concept of sunk cost bias. Additionally, the paper by Teisberg (1993) can be used to illustrate nine managerial decision making biases that increased project complexity: 1) underestimating uncertainty – the act of undervaluing ambiguity in facts and figures, which often leads to over-inflated confidence during the decision-making process; 2) belief that chance is predictable – the act of believing that luck may change as a result of specific actions; and 3) seeking only confirming evidence – the act of looking only for evidence that supports their predisposition, while overlooking information to the contrary.

**Stakeholders as a Source of Project Complexity**

The instructor can review the topic of stakeholder intent by examining how stakeholders and their interests increase complexity on projects. Lessons can focus on specific sources of stakeholder power on projects, methods that can be used to manage stakeholder interests, examination of the principal-agency theory, and the conflicts of interests between project owners and project managers.

According to Winch (2004), stakeholders are a diverse group and classified them as internal and external. Instructors can highlight the differences between internal and external stakeholders. By leveraging this paper, the instructor can focus on the dimensions of stakeholder power and influence.

Winch proposed several processes for stakeholder management, mainly: identify stakeholders who have a claim on the project, categorize each stakeholder's claim, assess stakeholder’s capacity to pursue such claims, and manage the handling of any claims. Instructors can discuss the process of 'stakeholder mapping' within clusters of either proponents or opponents and then relate these to the project mission, and any specific problems and solutions that can occur on your projects. Based on the identification of each stakeholder against the power/interest matrix, students can take part in classifying stakeholders according to relevant stakeholder power, such as: positional power, resource power, expert power, or relevant to a stakeholder's charisma to direct individuals’ opinions.

**Principal-Agency Theory, Conflict and Emotion Management**

To explain the complex relationship between project sponsors and project managers, the instructor can introduce the principal-agency theory, which explains the relationship between the agent and the principal, and the conflict that arises between the two (Turner & Muller, 2004). The instructor should stress the importance of strong communication, both formal and informal, to help resolve potential conflicts between the two parties. These lesson can also be complemented by the study of Berry, Davis, and Wilmet (2015) where the authors argued that emotional triggers need to be identified earlier in the project, or they will fuel emotions of anger and fear.
Leadership as a Source of Project Complexity

According to PMI’s Navigating Complexity practice guide, leadership is considered one of most critical drivers for navigation of complexity on projects. An examination of the importance of leadership as well as additional relevant aspects of project management, in helping project managers navigating complexity in projects, can be performed. Discussions on the concepts of nourishment, faultline theory, and strategies to leading high-performing and diverse project teams, would be particularly beneficial.

Successful leaders nourish the lives of their subordinates by fostering human connection. This includes rewarding good work and offering emotional support and encouragement when the need arises (Amabile & Kramer, 2011). The study offered four methods to help project leaders successfully nourish their employees: 1) treating employees with respect; 2) encouragement increases team members’ motivation for the project and their beliefs in their own effectiveness; 3) emotional support and empathy; and 4) affiliation for mutual respect. Moreover, the instructor can use the study by Ancona, Malone, Orlikowski, and Senge (2007) to examine four leadership capabilities that can be used for further discussions: sense making, relating, visioning, and inventing. The instructor can conclude by introducing faultline theory as it will help students understand how leadership can help or hinder high performance teams. The theory provides an explanation regarding the effects of team members’ age, gender, education, values, personality, and knowledge on the project performance as proposed by Gratton, Voight, and Erickson (2007).

Proposed Framework

Based on the factors discussed in this paper, the following framework is proposed in Table 1 to assist instructors in developing the course modules.

<table>
<thead>
<tr>
<th>Concepts/Sources of Complexity</th>
<th>Topics</th>
<th>Description</th>
<th>Sources</th>
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<tbody>
<tr>
<td>Project Complexity</td>
<td>Types and drivers of project complexity, and methods to address it</td>
<td>Definitions and forms of project complexity; Assembly, system, and array project complexities; Company politics, variety of project tools, dependencies, competition; Decentralize control, categorization and organization of system elements, removal of fragmentation; technology uncertainty</td>
<td>Baccarini (1996); Johns (2008); Shenhar and Dvir (2007); Bosch-Rekveldt et. al (2010); Johns (2008); de Bruijn, et.al (1996)</td>
</tr>
<tr>
<td>Human Behavior</td>
<td>Impact of human behavior; Roles of delusion and deception; Over-optimistic decision making; Types of biases</td>
<td>Unrealistic expectations of stakeholders, hidden agendas, unskilled resources; Delusion and deception; inside view error, anchoring, variant risk preferences; Exaggeration of personal talents; degree of control and fallacy in decision making; Changes in project time, project termination decision, sunk cost bias, underestimated uncertainty, belief that chance is predictable, seeking only confirming evidence</td>
<td>Lovallo and Kahneman (2003); PMI’s Navigating Complexity Practice Guide; Flyvbjerg et. al (2009); Dilts and Pence (2005); Teisberg (1993)</td>
</tr>
<tr>
<td>Stakeholders</td>
<td>Diversity of stakeholder interests; sources and dimensions of stakeholder power and influence; Principal-Agency theory, conflict and emotion management</td>
<td>Definition of stakeholders, diversity of stakeholders; Stakeholder mapping, power/interest matrix; Relationships between project manager and sponsor, building trust, interest, perception of progress, comfort and need of control</td>
<td>Winch (2004); Turner and Muller, 2004; Berry, Davis and Wilner (2015)</td>
</tr>
<tr>
<td>Leadership</td>
<td>Competencies for navigating project complexity; Interpersonal support and nourishment; Faultline theory and high performing project teams</td>
<td>Definition of leadership, organizational enablers; Respect, encouragement, emotional support, affiliation; Define volatility, uncertainty, complexity, ambiguity; Define faultline theory, examine team demographics, personalities, attitude, task and relationship-oriented</td>
<td>Amabile and Kramer (2011); PMI’s Navigating Complexity Practice Guide; Gratton, Voight and Erickson (2007).</td>
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Table 1. Framework of Concepts, Topics, and Recommended Sources
Conclusion

This paper presents a preliminary framework for the development of a project management course elective on project complexity. The four concepts outlined in the framework can be introduced sequentially via eight, ten, or twelve-module courses, by expanding on each individual concept accordingly. Instructors can use reflective journals and analytical assignments throughout the term to measure learning outcomes.

Future research can explore additional variables such as organizational complexity, resource capability, uncertainty, and performance metrics. Furthermore, lessons on project managers as integrators of all these factors would be particularly valuable to students of project complexity.

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REFERENCES


