

Custom Project Life Cycle Characteristics Study and Identification for Effective Manufacturing Company Transformation

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Abstract: *The demand for solution providers has been ever increasing. As a result, manufacturing companies have started the transformation in order to stay in business and for enhancement of growth prospects. However, transforming from hardware-centric to solutions-centric faces strong headwinds. To overcome this, they have started to apply customization on project life cycle to enhance the chances of success. Conversely, there is a lack of project life cycle characteristics that can be located. The customization work for project life cycle would be challenging without knowing and integrating the project life cycle characteristics into the development work, especially for manufacturing organization in high mix of low volume businesses. Hence, the authors aim to improve understanding of the value of custom project life cycle characteristics for manufacturing organization as well as to test the instrumental perspective of personalization theory for this non-numerical data driven study. The work suggests that custom project life cycle characteristics would be one of the key elements that enhances the chances of success for manufacturing company transformation. Moreover, this would allow researchers and practitioners to develop intangible customization of personalization of their own that suits and fulfils their needs.*

Keywords: Solution, Personalization Theory, Customization, Project Life Cycle Characteristics

1. Introduction

To cope with intense competition, manufacturing companies in metal, machinery, utilities, construction, and engineering industries attempt to differentiate themselves by solutions offering (for example, Rabetino, Kohtamäki, & Gebauer, 2017; Lütjen, Tietze, & Schultz, 2017; Clegg, Little, Govette, & Logue, 2017; Martinez, Neely, Velu, Leinster-Evans, & Bisessar, 2019). To manufacturing companies, solutions offering literally means business model transformation from hardware-centric to solutions-centric. To them, a solution is a customization by bundling the goods and services together to meet a customer's business needs (e.g., Davies, Brady, and Hobday, 2006; Sawhney, 2006; Tuli, Kohli, & Bharadwaj, 2007). However, customers tend to view a solution differently. To customers, their expectation is the integration of hardware, software, firmware, services and so on as a complete customization of solution. The difference in the two perspectives has resulted in lost sales opportunities, dissatisfied customers and more (Foote et al., 2001; Johansson, Krishnamurthy, and Schlissberg, 2003).

In a nutshell, project management serves as a mechanism that drives the fulfilment of a solution as part of operational discipline (Di Muro & Turner, 2018). Nonetheless, manufacturing companies continue to experience difficulties in delivering solutions successfully. For example, Schuh, Dölle, Kantelberg, and Menges (2018) and Papazoglou, Elgammal, and Krämer (2018) have applied project life cycle to increase the chances of success. Similarly, Orellano, Lambey-Checchin, Medini, and Neubert (2018) indicate that complexity, uncertainty, and unpredictability of business can be reduced by project life cycle adaptation. To the authors, no customization of project life cycle can be realized without mastering the project life cycle characteristics. Back in 2005, Ee (2005) suggested adding value and production of information as the top idiosyncrasy for project life cycle characteristics. The remaining five of the project life cycle characteristics outlined by Ee was supported by other researchers and practitioners (for example, Pradeep, 2010; Invensis Learning, 2018). In 2017, PMI & Agile (2017) delineated predictive, iterative, incremental, agile and hybrid under four pillars of deliberations: requirements, activities, delivery and goal as the project life cycle characteristics.

On the other side of the coin, no previous studies have been empirically conducted on the customization of project life cycle characteristics for solution projects. Certainly, an in depth study on this topic shall offer the intangible custom solutions for the problem statement in the high mix of low volume businesses. This has led the authors to pose the question, what are the characteristics of a typical custom project life cycle?

In order to answer the underlying question, the participation from an American based advanced analytical equipment company in the high mix of low volume business is crucial in allowing the exploration of the customization of project life cycle characteristics development. The solution projects in healthcare, education, and general electronics sectors that worth \$30k to \$500k per solution were the focus.

Correspondingly, the authors replace “intangible custom solution” and “sample company related asset” with “the development work” and “organizational” respectively. The former refers to the custom project life cycle characteristics that the authors develop, while the latter signifies “documents and/or practices” belonging to the manufacturing company involved in this study.

2. Literature Review

The literature review starts with the relationship between the development work and the solution. This is followed by the application of personalization theory, to which development work is the key result. In the last part of the literature review, the authors uncover project life cycle characteristics from other researchers and practitioners prior to organizational solution.

Solution to Customization

Eleven case studies completed by Herterich et al. (2015) indicate that the competition of business models for manufacturing companies that led them to solution offering has been ever-increasing in the past decade. To boost the chances of transformation success, Gudergan et al. (2015) believe their evaluation concept that is driven by clear operational goals and vision would help. To secure the success of transformation, Michalik et al. (2018) worked on strong linkages between digitized customer data and solution. To boost the chances of transformation success further, Rasouli et al. (2015) have implemented numerous dynamic capabilities targeted to resolve operational challenges for solution. To improve chances of

success, Raja et al. (2017) conducted a study on three Denmark based manufacturing companies which are in the same industry. All the three sample companies revealed major customization to their services as a solution for business model transformation.

Personalization Theory

From 1986 till 2003, the personalization theory was very much explored in the emotional domain by multiple researchers and practitioners (Wells, 2000; Rodin, 1986; Holman, 1986; Blom & Monk, 2003). The research works cover a wide sampling, be it in the office work environment, emotional responses for elderly residents in a nursing home, emotional ties between the user and the product, to understand why humans choose to personalize. There was an evolution on the studies on personalization theory in 2006, from the emotional perspective to emphasis on the final product and/or solution (Fan & Poole, 2006). The authors chose instrumental perspective of personalization theory by Fan and Poole's (2006) as a theoretical lens to address RQ. Functionality and usability that highlight the importance of the customers situated needs are the main focus of instrumental personalization.

Customization

Researchers and practitioners have defined customization in different ways (Nielsen, 1998; Pine & Gilmore, 1999; Wind & Rangaswamy, 2001). Although researchers have expressed customization in different fashions, undoubtedly, manufacturing companies' commitments are focused on fulfilling customers' needs. This action matches with the concept of personalization theory. To stay relevant in the market, manufacturing companies are required to customize their existing design and simulation tools that they have been using throughout the entire project life cycle from research and development to services. The same can be said on a case study from Dombrowski & Malorny (2018), where lean service systems were customized to enhance custom satisfaction and loyalty. For this study, the development work is demonstrated through the sample company. Under one to one condition, sample company has showcased their key differentiators to potential customers privately. In response, individual customers approached the sample company to fulfil customized solutions for their specific needs.

Project Life Cycle Characteristics

Ee (2005) described, the chances of value adding by cost control are highest during the first phase and lowest during the last phase. Ee also emphasized that communication and retention of the information developed in the first two phases are vital for the subsequent phases to enhance the chances for project success. Speaking of probability of project success, Pradeep (2010) had the same view with Ee. For uncertainty and financial commitment, risk and uncertainty levels are greatest during the first two phases and will be gradually reduced when more information is made available throughout the project (Ee, 2005). This view has been supported by Invensis Learning (2018). And most of the researchers and practitioners agree with the project life cycle characteristics mentioned above. PMI & Agile (2017) came up with a revolution, in which project life cycle characteristics for predictive, iterative, incremental and agile are outlined in a table under four pillars of deliberations: requirements, activities, delivery and goal. However, project life cycle characteristics for hybrid is introduced in the form of sentences rather than included in the table mentioned. For that, the authors decided to table out the characteristics for hybrid approach as a combination from predictive and agile approaches in Table 1. Conversely, no project life cycle characteristics for customization can be identified. The authors decided to apply life cycle characteristics discovered in Agile Practice Guide recommended by PMI & Agile as a start for this study.

Table 1: Characteristics of the hybrid project life cycle.

Project Lify Cycle Characteristics				
Life Cycle	Requirements	Activities	Delivery	Goal
Hybrid	- Fixed - Dynamic	- Performed once for the entire project - Repeated until correct	- Single delivery - Frequent small deliveries	- Manage cost - Customer value via frequent deliveries and feedback

Organizational Solution

In the course of the investigation carried out, five organization solutions were discovered in the sample company owned solution roadmap since the sample company was at the juncture of shifting from hardware-centric to solutions-centric.

3. Methodology

The study begins with defining the method used for literature review. Subsequently, the steps involved in the identification of a custom project life cycle characteristics are unveiled in great detail.

Systematic Literature Review

Instead of a conventional literature review, systematic literature review has been chosen to answer the context-related portion of the RQ by locating relevant data from multiple sources in the longitudinal manner for all topics related to this study, prior to analysis and conclusion into creditable results (Yin, 2018; Saunders et al.,2016). The five-step process outlined by Pawson, Greenhalgh, Harvey, & Walshe (2005), was utilized:

Step 1: Clarifying the scope: The authors conducted systematic literature review guided by the questions: Q1 - “What is the relationship between solution and customization?” and Q2 - “What are customization, project life cycle characteristics, and what are the organizational solutions delivered in the past?”

Step 2: Searching for evidence: This step centres on the number of literatures found in each of the topics, and also when the search should be terminated. For this, the authors have limited the search until April 2019 to yield up-to-date knowledge.

Step 3: Appraising primary studies and extracting data: Literatures located were probed based on whether they are related to solution, customization, project life cycle characteristics by reviewing abstracts and conclusions. Prior to this, they were read in detail, analyzed, and interpreted.

Step 4: Synthesizing evidence and drawing conclusions: Interpretations from Step 3 were collated to minimize the potential bias to the minimum (if any).

Step 5: Disseminating, implementing, and evaluating: The interpretations from Step 4 were used to develop the development work.

Identification of Custom Project Life Cycle Characteristics

As shown in Figure 1, solution, personalization theory, customization, project life cycle characteristics for different types of project life cycles and organizational solution found in the systematic literature review were thoroughly analyzed. Next, custom project life cycle characteristics tabled under four pillars of deliberations were determined as the outcomes for

development-related portion of RQ whereby, requirements, activities, delivery and goal were the focuses.

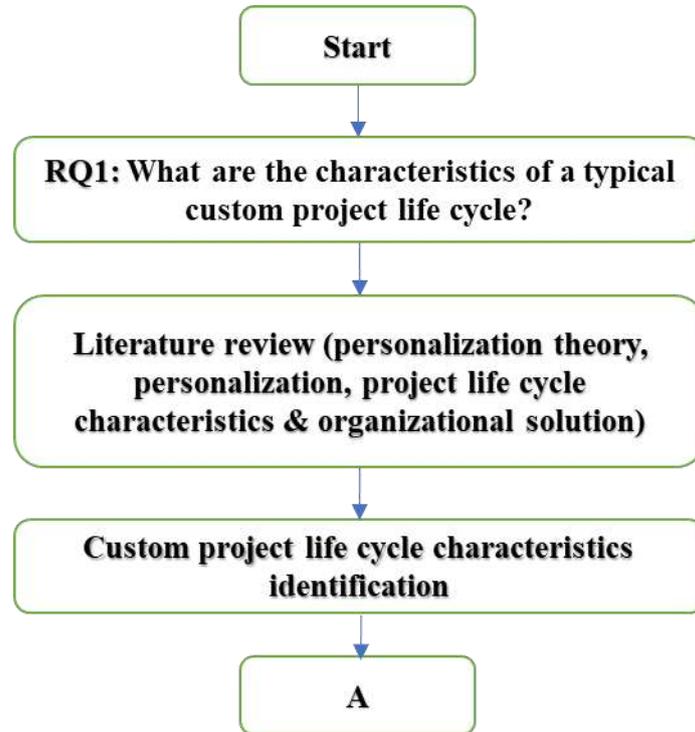


Figure 1: Flowchart depiction for custom project life cycle characteristics identification.

4. Results and Discussion

In this section, result from custom project life cycle characteristics is discussed. The outcomes from systematic literature review are outlined in section 2.

Custom Project Life Cycle Characteristics

Agile Practice Guide recommended by PMI & Agile (2017) does reveal some of the characteristics that match with solution business model, eventhough not entirely. For illustration, Goal’s consideration for solution projects does meet all the three charateristics from predictive, iterative and incremental project life cycles. In order to connect the dots and to align to instrumental personalization’s main focuses, the author suggested customization of charateristics for project life cycl chareacteristics as shown in Table 2.

Table 2: Characteristics of the custom project life cycle.

Project Lify Cycle Characteristics				
Life Cycle	Requirements	Activities	Delivery	Goal
Custom	- Fixed	- Repeated until correct	- Single delivery	- Correctness of solution, speed and manage cost

Table 2 above uncovers the complete characteristics for custom project life cycle. The requirements from the customer are finalized into a legal binding Statement of Work (SOW). Subsequently, under the activities, the solution under development is designed, refined and iterated until it met all the requirements stated in SOW prior to single delivery to the customer. Here, the customer is going to receive the very same solution that had been through the solution under the activities. This is different for standard product and service, whereby twenty to forty prototypes were usually built for testing purposes per build. In the event

where the customer decided to change the requirements, all activities shall cease immediately, and amendment of SOW shall take place prior to re-quoting. SOW shall be signed by both parties (customer and the manufacturing company) and differences in quotation will be issued to the manufacturing company via Purchase Order (PO), before any work resumes. In terms of goal, it is imperative to deliver a solution that meets all the requirements including delivery date governed under SOW within the budget. These exceptional characteristics have clearly distinguished the uniqueness of custom project life cycle from other project life cycles.

5. Conclusion and Recommendations

This study has successfully identified custom project life cycle characteristics in four columns of deliberation, namely, requirements, activities, delivery and goal. All four reflect the nature of the solution to be developed. The outcome of this work enhances the chances of success for manufacturing company transformation. It provides a reference for manufacturing companies in the high mix of low volume business sector as well as in similar industry to create their own solutions to increase the chances of success when transforming from hardware-centric to solution-centric. However, this study is limited by the methodology chosen, the scope, and time availability. The authors suggest extending the study to include solution projects with higher deal sizes, other manufacturing business sectors, and the use of qualitative and quantitative methods when carrying out the research.

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