Research Article

The Use of Repeatable Components in Hybrid Models to Enhance Software Project Management Success

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Abstract: The management of software project development requires a dynamic and reactive environment to meet shorter time-to-market demands to address competition efficently in the software industry. This scenario requires the use of effective and robust methodologieswhere opportunities are not lost due to delays and failures in timely software project deliveries.The Agile Manifesto in 2001 which introduced 4 values and 12 principles was designed to develop and manage software projects in a more suitable and effective way to improvethe success rates of software projects. But, increase in overall success rates are still not significant with failure rates remaining plauteaued at about 30% over the last 10 years. Hybrids methodologies seem to have worked better as agile hybrid management methodshave shown more promise when compared to pure agile methods with an overall success rate increase of 16%. There is evidence too that by combining agile methodologies with traditional methodologies, there would be a further increase in success rates. Whilst many hybrid methodologies have been suggested and researched, the gaps in the literature review reveal there is a lack of hybrid models that have been empirically developed and studied as second order components. To build a robust hybrid model, it is important to gather the relevant information and careful consuideration must be given to the design of the questionnaireto fit second order components and models must incorporate and provide for the use repeatable ways to test models once the data is collected.This paper presents a review of the current gaps in hybrid methodologies and proposes a questionnaire design that supports the research methodology and empirical study to be undertaken with second order components (Constructs).Further it looks at the design approach in questionnaires which incorporates the use of repeatable constructs and the measures used and emphasizes this as an important ingredient for developing and testing hybrid models in research studies.

Keywords: Questionnaire, Design,Traditional, Agile, Methodologies, Repeatable, Hybrid.

1. Introduction

Project management as a discipline that is not categorized as an exact science and the primary constructs in a theory are required to be well defined (Gregor, 2006) and provide a clear context in the manner it is used (Eri et al.,2012; Niknazar & Bourgault, 2017) and how it is queried (Saad et al., 2014; 2016; Alwan et al., 2016; 2017).

Hybrid architecture is a common feature that maintains reactive behaviour in dynamic environments (IskandarIshak et al., 2012; Sidi et al. 2013;Yang, Mao, Yang, & Liu, 2017). In a similar context, software development activities are managed in dynamic enviroments(Jabar et al., 2014; Schelling & Pierling, 2015; Gheni et al., 2016)that require reactive approaches (Yang et al., 2017; Sidi et al., 2017; Hussain et al,. 2016)to meet shorter time-to-market demands(Spalek, 2016) and hybrid architectured methodologies have provided opportunities as software project success rate have increased by 16% (Papadakis & Tsironis, 2018).

A hybrid software project management methodology is defined as a combination of traditional and agile software development methodologies and philosophies to create a collective interaction of combination patterns and tailoring strategies (Kuhrmann et al., 2018a; Papadakis & Tsironis, 2018; Hussain et al., 2016).

A recent CHAOS report in 2018 (Figure1) provides evidence of a success percentage hovering between a range of 27% - 31% with slight improvements over the years. The report reviwed data from over 50,000 projects software projects which ranged from tiny enhancements to massive systems re-engineering and implementations. The definition used for failure in the CHAOS report was done on failed projects which typically include projects completed but with a very poor quality both in the product and the processes used (Magne Jørgensen, 2014).

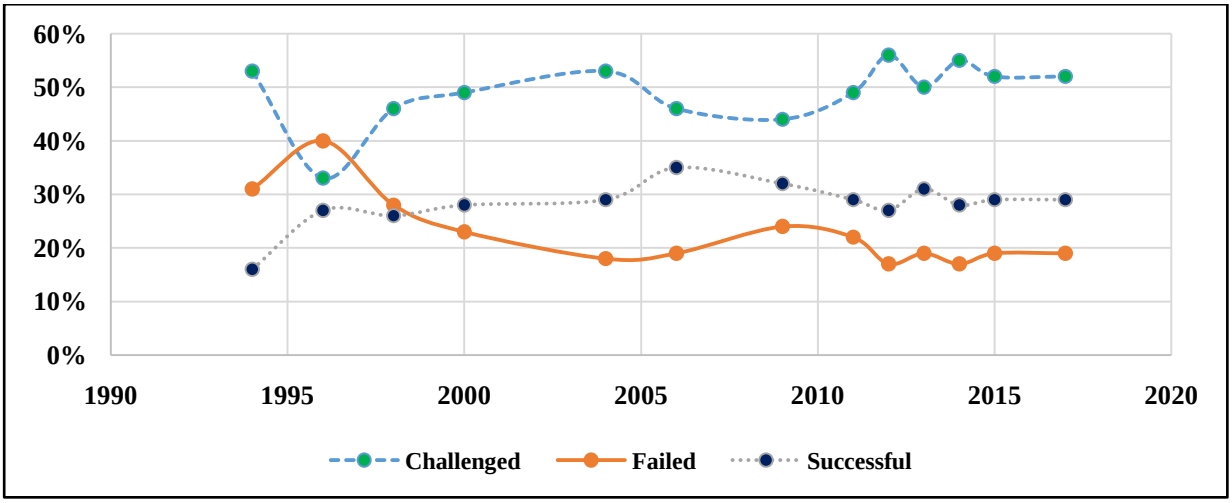

Figure 1.2018 CHAOS Report on IT Software Project Performance

Studies in this area would require an initial and independent look at the traditional and agile software project management methodology characteristics and an eventual review of the combined characteristics through models that support the various concepts and theories.

The study of characteristics can be viewed as the study of indicators in the development of constructs and models and the use of repeated indicators are primarily useful in the hybrid model development to assist in striking a balance between the two methodologies due to similarities and measures of success between the two techniques(Papadakis & Tsironis, 2018)

Careful consideration is necessary for the design of questionnaires (Roopa S, 2012) which should include the various characteristics as constructs and indicators which use measures and provide for repeatable constructs to study the proposed model in terms of its validity and fit.

2. Materials and Methods

A review of the gaps in current traditional, agile and hybrid project success management models reveal that the hybrid architecture that requires a reactive behavior and a dynamic environment is not evident (Table 1). To build efficient hybrid constructs, the gaps in traditional and agile constructs must be combined as gaps in hybrid construct to exist as repeatable gaps when the overall model is tested. Variables should be introduced (also termed as indicators in some research papers) with measures used to formulated the type of questions that will be required in the questionnaires. This fulfils the basic architecture in hybrid models and design of the questionnaire.

Table 1. Current Gaps and Constructs in Traditional, Agile and Hybrid Models

Research Gap in Project Success Models	Model Constructs	Literature
- Insufficient conditions to meet delivery timely - Insufficient studies on adaption - Unable to identify quick solutions for small projects.	Traditional	(Papadopoulos, 2015; Spalek, 2016)
- Ineffective management of tailoring activities - Unable to identify solutions for large and complex projects	Agile	(Vedsmand, Kielgast, & Cooper, 2016; Wells, Dalcher, & Smyth, 2015)
- Not managed in a systematic, efficient and reliable manner for medium and large projects - Corporate implementation is limited - Not able to combine models. - Combination techniques not working well. - Benefits not efficiently realized - Improvement in management of contextual dependency.	Hybrid	(Conforto et al., 2016; Kuhrmann et al., 2018b; Rauf & AlGhafees, 2015)

A summary of the gaps are provided in Table 1. As hybrid models have a 16% increase in success rate than pure models(Carvalho et al., 2012), a new hybrid project management model was developed and proposed to close some of the gaps instead of developing a new pure traditional or a new pure agile model.

Table 2. Questionnaire Design for the 4 Components

Component (Constructs)	Questions Ordinal (Likert Scale) -Items	Literature
1-Traditional (T)	11	(Jørgensen, 2016;Gill et al., 2016; Takeomi Imani, Masaru Nakano, 2017)
2-Agile (A)	9	(Fontana et al., 2015; Jørgensen, 2016; Takeomi Imani, Masaru Nakano, 2017)
3-Hybrid (T+A)) (Repeated from 1+2 above)	20	(Serrador & Pinto, 2015; Cooper, 2016; Davis, 2017;Takeomi Imani, Masaru Nakano, 2017)
4- Project Success (S)	9	(Dao, Kermanshachi, Shane, Anderson, & Hare, 2016; Takeomi Imani, Masaru Nakano, 2017; Wood & Ashton, 2010; Nguyen et al., 2018)
Total	**49**	

An instrument in the form of a questionnaire was designed with the set of indicators that were used as measures in the model. The design comprised a set of 4 components (constructs) with ordinal (Likert-scale) questions for each component which ensured repeatable indicators could be used for analysis (see figure 3). This is summarized in Table 2.

The conceptual representation of hybrid components (constructs) is provided in Figure 2. Items in 1st order construct will be represented as repeated items in the 2nd order construct (Wilson & Henseler, 2007).

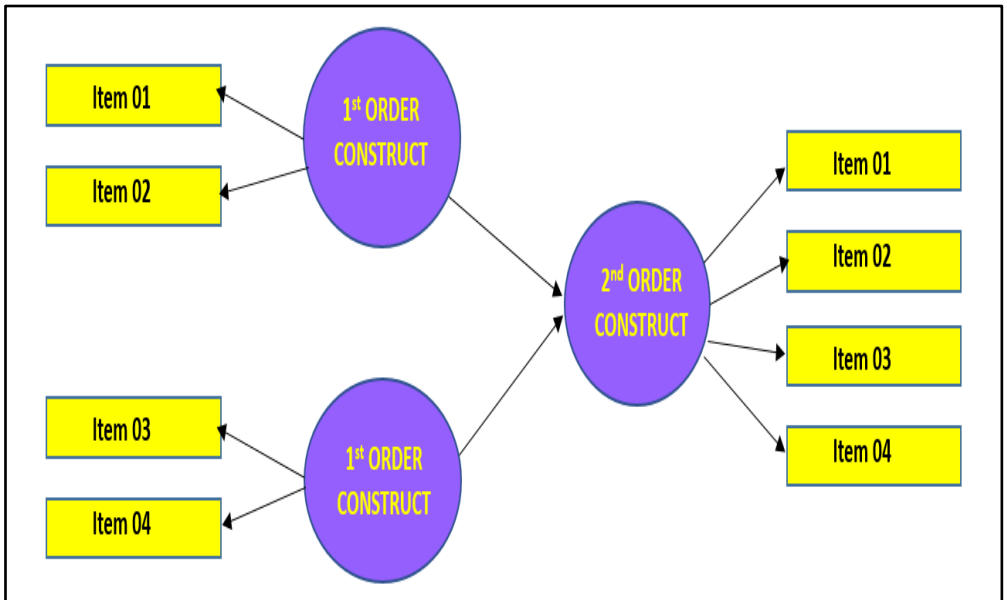

Figure 2. Conceptual representation of a Hybrid Construct with Repeatable Indicators

The agile hybrid proposed model was also developed from existing traditional and agile characteristics as combined for the hybrid construct to address the gaps. The proposed model and the measurement indicators are provided in Figure 3.Due to a large number of indicators the abbreviation '01 to nn' is used, e.g. T01....Tnn for Traditional Model indicators.

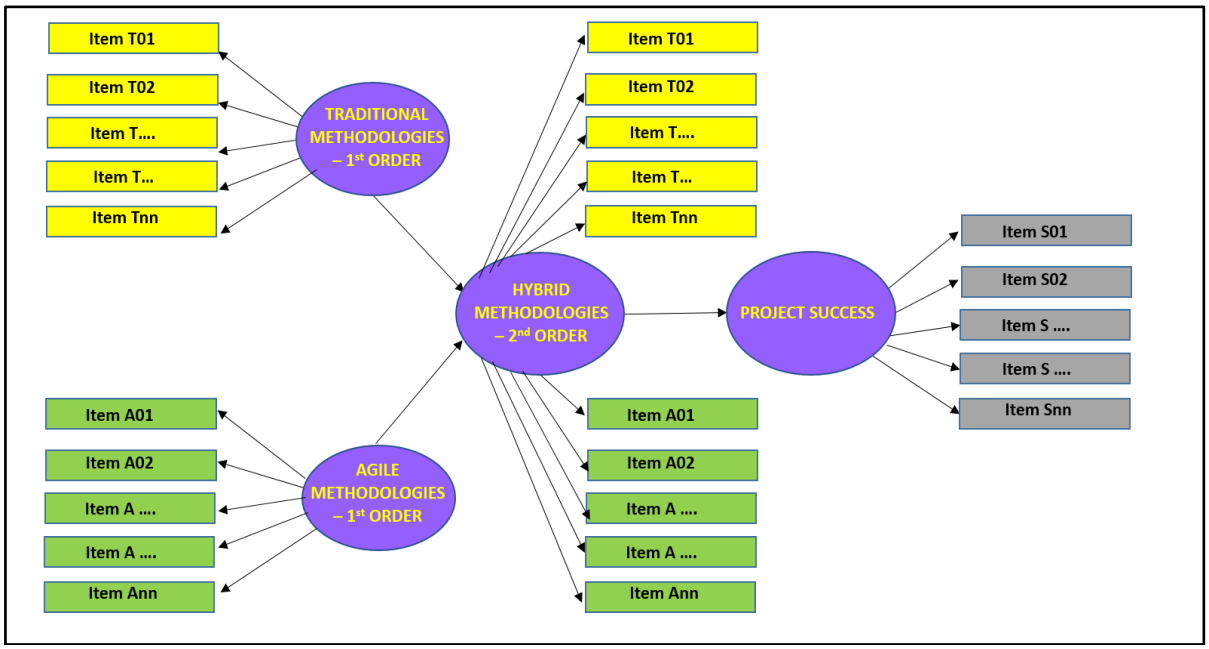

Figure 3. Repeatable components (items) for hybrid models

Data from 296 respondents for the various components (used as constructs) in the model were collected and a model fit was obtained using the SMART-PLStool. The hybrid component required the 1st order and 2nd order analysis to evaluate the model fit.

3. Findings

The analysis for a model-fit using SMART-PLS is provided in Table 4. A value of 1 for the hybrid component indicates that the items in traditional and agile methodologies are fully represented and provides a clear and accurate repeatition in the inclusion of the test and fits the model well. The project success component identifies that 75% of the indicators have attributed to the success from the hybrid components.

Table 4. Model-Fit Analysis

Components/Constructs	Model Fit
HYBRID METHODOLOGIES	1
PROJECT SUCCESS	0.755

4. Conclusion

The questionnaire design and the model fit analysis provides a good basis for researches that use hybrid model to have repeatable indicators and use 1st and 2nd order construct analysis to determine the model fit. As the data used in the analysis is a good sized sample for a specific interest target group, it is reasonable to suggest that a larger sample would increase the project successmodel fit percentage with more refined questions and further improve the model-fit analysis and values.

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