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Application of Systems Engineering to Risk Management:
A Relational Review

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ABSTRACT

System engineering is an interdisciplinary field of engineering and engineering management that focuses on the design and management of the system. The system as a whole is the concern, which is followed by more technical aspects of the system, the design of everything, and the management of a complex system. Inspecting and making the system more efficient is the focus for system engineers. Additionally, risk management is being able to predict, evaluate, and solve risks that are going to happen or may happen in the future. There are three models that help system engineers with making a complex system look simpler and less frightening: the Vee, Spiral, and Waterfall models. While system thinking is a very important part of system engineering, there always has to be a collection of data to study for making decisions. As of now, there is no explanation in literature how these variables, their concepts, and models are beneficial to project management. This has created a research gap, so the study examined the most current variables, their concepts, and models in operations and project management. Furthermore, a design-science-investigate strategy was used to approve a valuable growth reveal for both reasonable and hypothetical application. As a result, an assessment model was generated to fill the research gap and to contribute to the engineering field through improved project success rates and team communication.

KEYWORDS

Risk, Risk Management, Systems, Systems Engineering

INTRODUCTION

Systems engineering has been a reliable and efficient addition to risk management. System engineers have a better understanding of making decisions for a project or company because system engineering has an understanding of other engineering fields, such as mechanical, aerospace, chemical, and project management. The engineering of a system is a discipline that develops and trades off requirement, functions, and alternative system resources to fill a cost-effective, life cycle balanced product that is based upon the needs of the stakeholders. Applying the risk management aspect with system engineering creates a more focused product that would reduce failure in more than one direction of the product. Since SE has a focus in more than one field of engineering, it would help the product to be more advanced and secure in more than one dynamic.

System Engineering (SE) has discipline and a way of thinking that is gaining popularity in many large projects. The industry's literature commonly defines a project as an "endeavor in which

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human, material, and financial resources are organized, in a novel way, to undertake a unique scope of work, of a given specification, within the constraints of cost and time, to achieve a beneficial change defined by quantitative and qualitative objectives" (Mabelo & Sunjka, 2017; Elloumi et al. 2017). Project management is defined by The Project Management Institute (PMI) as "the application of knowledge, skills, tools, and techniques to project activities to meet project requirements" (Mabelo & Sunjka, 2017; Memon, & Meyer, 2017). The key to this definition is the emphasis on "meeting project requirements" (Mabelo & Sunjka, 2017; Brown & Eisenhardt, 1995; Detert, 2000; Easton & Rosenzweig, 2012). This study compares project management to SE and shows that they are very similar, but systems engineers have more knowledge and experience working in different fields and with different forms of engineers. Thus, the primary person who would interact with management, customers, suppliers, and specialty engineers in the development of a system process is the SE.

While risk management is the identification, evaluation, and prioritization of risk, it consists of finding the risk that appears, defining it, solving it, and continuing with the project. Ensuring that uncertainty does not interfere with the project for the project to be accomplished with little to no delays is the main objective. There are two steps to project risk management on how to manage, identify, and control the risk that has come up in a project. First, project managers start with planning on how risk would be dealt with. Next, he would assign a risk officer to oversee the risk and potential project problems. While the risk officer is overseeing the risk, he would create a database for the risk with information of when it started, as well as the probability and the level of importance. Then, he would have another step, but the most important aspect would be the mitigation plan on how to deal with the risk and whether it can be avoided or fixed. These risk management steps are important to project management because the project must fulfill the satisfactory level of the client for him to enjoy the product.

Optimizing the system-engineering process by strategic models and operation research was our research objective to improve risk management in an organization. Model-based systems engineering is the use of models for analyses and document key aspects of the life cycle. SE goals with models are improving their communications with engineers, project teams, and trying to overcome any language barrier. Improving quality is an objective of SE, which is a very integral part of a project. Mostly, how well you would like it made and the allocated budget are two of the most important aspects of a project. Identifying the requirement of risk early, enhancing any design, improving specs of requirements to hardware or software, and reducing errors in the whole project were our research objectives. Also, increased productivity is a great way to improve your scheduling and to plan to save time or to reduce delays in any task of the project. Even reusing existing models on projects to support the design and technology evolution is a great way to increase productivity, as it is a well-known model to which coworkers would not have to adjust. Risk and the reduction of risk are very crucial to SE because it is one of the main concerns for the project. Overall, improve cost estimates to make them more accurate is a goal of SE, which would reduce the overspendings.

Observing current literature showed us that there was a research gap, regardless of research on the importance of these variables, their concepts, and models in operations and project management. Information about how these variables, their concepts, and models caused such a smooth progression was insufficient, which was what this study aimed to discover. The elements and applications for the most current variables, their concepts, and models within operations and project management were also assessed to find their overlaps and similarities.

This research was meant to contribute to, as well as to expand upon, literature about the effectiveness of these variables, their concepts, and models. Furthermore, this study assessed the likenesses and differences of their assessment tools. Data within this paper was derived from multiple studies that have also tested the hypotheses in this paper.

Many research perspectives were adapted in this study to find new solutions to current issues. This research's study and hypotheses were explained, as it first used a design-science-investigate approach. This study then approved a valuable growth reveal for reasonable and hypothetical application, and it