

Managing testing activities in new product development and manufacturing

Supervisors:

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Project Description:

Currently, manufacturing industries are going through massive transformations in restructuring their products and processes by introducing and adopting new technologies to meet NetZero and sustainability targets. These new technologies enforce product design and manufacturing processes changes, especially how these products are tested for quality assurance and validation. Testing plays a significant role in assessing Technology Readiness Levels (TRLs) and in new product development for quality assurance. A significantly increasing number of physical and virtual testing are essential to ensure quality and validate the product, especially for a complex product with many components and subsystems such as cars or aircraft. For example, the need for enhanced testing of new technologies, including low carbon hydrogen production and heat recovery, is highlighted in the UK Industrial Decarbonisation Strategy 2021 (Government 2021). A key question arises: when there are uncertainties around the new technology and where the standard process and years of experience are not available, how do companies plan and manage testing activities that provide the optimum balance of quality assurance versus cost and time?

Physical testing is time-consuming and can count up to 30 to 50 per cent of the total development cost in automotive and aerospace industries (Sudol and Mavris 2018, Tahera, Wynn et al. 2019). Therefore, there is an industrial need to reduce physical testing costs and speed up the development process, foster the learning benefits of the testing activity from different stakeholders, and better manage the testing activities (Tahera, Earl et al. 2017). A significant effort goes into virtual testing (i.e. computer-aided engineering (CAE) and modelling and simulation) to assist physical testing. A critical trade-off is how much physical testing can be reduced without compromising the quality, especially for radical emerging technologies requiring comprehensive testing.

Testing strategies can be different for incremental or innovative new product development. Incremental product development perceives minor improvements or simple changes to existing products, so testing focuses on the changes and mostly on verification and

validation (Tahera, Wynn et al. 2019). But for the radically new product with major improvements in 'technological capability' or/ and 'product capability', testing also needs to focus on experimentation (Erat and Kavadias 2008), demonstration (Thomke 2007), and refinement (Camburn, Viswanathan et al. 2017), as well as testing the product concept with customers (Cooper 2019). The supplier's product validation testing also plays a significant role in new product testing. Access to the supplier testing results and data can bring a better understating of components' performance and behaviour and dramatically reduce component level testing in the main company (Tahera, Earl et al. 2014). Therefore, a collaborative effort to integrate test plans, analysis results, and corrective action workflows across suppliers, internal, and customers is essential.

Testing for the incremental product is based on traditions, standards, and procedures; however, companies need to take different strategies when planning testing activities for radically new products. There is very limited research in this area, and a pragmatic method of supporting testing strategies for new product development is needed.

Research methodology

This research aims to investigate the roles and how testing activities are planned when companies develop a radically new product with new technologies. The research methodology will be based on case studies with automotive and aerospace manufacturing industries to identify and categorise different roles of testing. Data will be collected through semi-structured interviews, observations, and document analysis. The modelling technique will be used to capture and determine how these testing activities are linked with other testing and product development activities from different stakeholders to establish the information flow relationship. This study will help develop testing strategies and effective testing planning methods to reduce product development effort and cost.

About the Supervisors:

Dr Khadija Tahera researches product development, manufacturing and operation management, focusing on improving testing processes in collaboration with industries to establish best practices. Her recent publications and doctoral supervision concentrate on new product development and production process improvement through case studies, modelling and simulation.

Dr Christopher Earl, Emeritus Professor, School of Engineering and Innovation, has researched Design and Manufacturing Processes in several projects, currently co-investigating on EPSRC 'Design Configuration Spaces' (2018-2022) at Leeds University (Schools of Engineering, Business and Computing).

Gordon Liu is a Professor of Marketing Strategy at the Open University Business School. His work is situated at the intersection of marketing, strategy and entrepreneurship. He has a particular interest in marketing strategy (related to the combination between CSR and

marketing_, product innovation/new product development, strategic orientation/capabilities, and networks/strategic alliance.

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