Understanding and Supporting Dynamic Capabilities of Design Teams in Production of Technology-Innovation

Rapid adaptation to a changing environment is essential for the survival of incumbent companies, but the capabilities required to lead the disruption of a technological trajectory are generally challenged by the process management activities that make the company operate efficiently within its current environment. This study explores the practices of engineering designers that are executing disruptive innovation projects for DONG Energy, a Danish energy utilities company. The aim of the study was to understand the role of the designer in disruptive innovation and to create a tool for supporting multidisciplinary design teams, while creating disruptive innovations. The results from this study are presented in five research Papers that address the following themes: 1) the willingness of engineers to follow formal procedures, 2) critical knowledge domains in front-end technology decisions, 3) knowledge management challenges when moving from front-end to product development, 4) the development of mechanisms for balancing exploration and exploitation activities in the processes of innovation, and 5) validation of mechanisms and boundary object creation by embedding it in the support tool Ensight for implementation and testing. The research design was based on the design research methodology (DRM) and case study research, with primary data collection conducted at DONG Energy through participating observations, large-scale workshops, interviews and experiments. The data amounted to a total of 486 hours of realtime observations, six interviews, and two workshops. To interpret the data, a theoretical framework was built on theories and concepts from engineering design processes, innovation processes, knowledge management, and intellectual capital.

The central findings from the study can be summarized as follows: 1) the effective implementation of new or radically changed methods and processes was found to be effectively supported by co-creating the method with the company; 2) the domains of knowledge that need to be covered by a disruptive design team include several fields that are not traditionally associated with product development, such as market design; 3) the diversity of these domains was found to increase the barrier for effective transition from the front-end phase to the product development phase; 4) the transition gate was found to be a separate phase, with its own knowledge-management challenges; 5) a model of central mechanisms for supporting a messy innovation process with unpredictable flow was created by decoupling innovation support from the phases; and 6) embedding these mechanisms into a simulation game enhances the quality and quantity of disruptive concepts through the ability of the game to span and represent boundaries between knowledge domains. The study contributes to research from this study include new perspectives on how capabilities for supporting disruptive innovation are created on the level of design teams. The study found that punctuated equilibrium exists on a micro-scale within an ambidextrous organization and that successful disruptive innovators are able to balance and synchronize exploration and exploitation without the support of process management. Furthermore, the study contributes to product development theory with an extended view of what defines the design dimensions of a product; factors such as market design were perceived to be essential design dimensions for the expected success of a product. This type of knowledge was successfully embedded into an object capable of spanning the boundaries of a multidisciplinary design team and of representing absent knowledge in the design team.

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