

審査の結果の要旨

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Mr. Nomura's dissertation is titled "The advantages of systems integration as a technical and business strategy - the case of the Photovoltaics industry" (技術的経営戦略としてのシステムインテグレーションの有効性ー太陽光発電産業の事例ー). It discusses the definition of systems integration and how it has been analyzed in academic literature to date. It shows that most of this analysis has been in the context of projects involving complex products and services (CoPS). These typically are customized, large, one-off projects in industries that are geared towards such projects (so-called CoPS industries). One of the achievements of this dissertation is that it analyzes systems integration in a non-CoPS setting, in this case, in an industry, photovoltaics (PV), that shares some similarities with CoPS industries (many PV projects are large and customized). But in other aspects the PV industry is quite different from typical CoPS industries, for example, generally being quite competitive and involving production methods that rely extensively on off-the shelf, mass produced components.

In addition, the dissertation shows how systems integration is becoming an increasingly important core business and technical competence for companies in the PV industry. It also discusses some of the challenges companies face in developing systems integration capabilities. Japanese PV companies are among those that have struggled to develop systems integration capabilities for operations outside Japan. The dissertation analyzes these difficulties and provides a road map for some Japanese PV companies to increase their global competitiveness by building international systems integration capabilities.

Finally, the dissertation indicates that systems integration as a successful business strategy is not confined only to the PV industry, but likely is important in other non-CoPS industries, especially those, such as robotics and smart cities, that involve rapidly evolving sophisticated technologies but not in large, customized, one-off CoPS projects.

A chapter by chapter summary follows:

Chapter 1: This chapter includes background information and a literature review. It also draws the distinction between CoPS and CoPS industries on the one hand, which have been the focus of most prior analysis of SI, and the PV industry on the other hand, which has characteristics distinct from typical CoPS industries. This chapter also outlines the purpose and structure of the overall dissertation.

Chapter 2 provides a working definition of systems integration and describes the methodology for the main analysis.

Chapter 3 chapter explores in-depth systems integration in a CoPS setting contrasted with systems integration in a non-CoPS setting (PV). These two SI-settings are also contrasted with general construction, an example of an industry where much coordination is needed, but this coordination does not rise to the complexity and sophistication of coordination performed by systems integrators. In particular, in general construction, most components and technologies are standardized, unlike the PV and CoPS industries where cutting edge, rapidly evolving technologies must be integrated in creative ways, and such integration involves coordination with companies that control highly sophisticated component technologies.

Chapter 4 analyses in-depth systems integration in the PV industry. It illustrates systems integration functions in this industry by means of a case study of construction of a PV plant in Thailand by a German company in Thailand. It analyzes in-depth the four leading German PV firms and how systems integration came to be an important part of each of their business strategies. It also analyzes the general international landscape of PV companies, summarizing the activities of major PV companies the world over, ranking them according to sales and indicating the extent to which SI is becoming a core competence in each.

Chapter 5 describes systems integration in Japanese PV companies. It notes that Japanese PV companies do perform SI functions, but mainly in domestic projects. Large Japanese PV manufacturers have tended to avoid developing competence in systems integration, relying instead on selling manufactured panels. However, a few small or medium size Japanese companies have made progress in providing systems integration services for projects outside Japan. The chapter includes a case study of such a project in the Philippines.

Chapter 6 analyzes the hypothesis that systems integration capabilities provide a competitive advantage for companies in the PV industry. It contains a Spearman Rank-Order Correlation analysis of 11 companies. While the results are inconclusive, due possibly to the small sample size, the chapter also contains case studies of how one American and one German company switched from manufacturing to systems integration as their main business focusses and in the process turned the fortunes of their companies around.

Chapter 7 synthesizes the results from previous chapters to summarize and highlight key systems integration capabilities in the PV industry. While the main capabilities are engineering based skills to understand the importance of various components, optimize their combination in various settings, and provide post-installation support to customers, other key capabilities that PV companies are using to distinguish themselves from competitors include being able to interact with local governments, acquire land rights and right of way access for power lines, integration into the power grid, obtaining of financing and guaranteed power purchases, etc.

Chapter 8 summarizes the main findings of the dissertation, both in terms of expanding academic knowledge of systems integration and in terms of providing practical insights relevant to companies that might be considering developing systems integration capabilities.

The appendix provides examples of other non-CoPS industries where systems integration is proving to be an important capability, notably robotic systems and smart cities.

The evaluation committee unanimously agreed that the dissertation is satisfactory and meets the standards for Mr. Nomura to be awarded a doctoral degree.

よって本論文は博士（学術）の学位請求論文として合格と認められる。