

**Project Report to International Motor Vehicle Program (IMVP), M.I.T.  
International Assembly Plant Study  
" Management of the Extended Enterprise" Research Team<sup>1</sup>**

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During the past fiscal year, we have worked closely with a number of researchers from around the world to develop a questionnaire that will provide us with a fuller understanding of the value-chain issues that surround current automobile manufacturing. While centered on the assembly plant, we are also looking at the interface between the plants and their suppliers, as well as the plants and their distributors. We will summarize these efforts, as well as our timetable for data collection. In this write-up we are focusing only on the work undertaken in relation to assembly plants. We have also done extensive work in the Modularization/Outsourcing project that is helping to pave the way for some of the assembly plant work; please refer to the separate report on that project.

### **Survey Development and Feedback**

We spent a large amount of time this year finalizing the survey. We devoted considerable effort to developing new questions on the broader issues related to the extended enterprise. We also did a detailed analysis of Round 1 and Round 2 to determine which questions were critical carry-overs. The new survey continues to capture data on the topics we have always covered, such as labor productivity, product variety, work organization, and use of buffers. We have streamlined these questions, and in many instances have expanded them to explore new fruitful lines of inquiry. We have also worked with a large number of researchers internationally to develop questions on new topics, including the following:

#### ***Modularization:***

We are taking a multi-pronged approach to address the issue of modularization from the plant's perspective. We explore in detail the level of modularization for three key components: headlamps, door inners (with some questions on door structures as well), and dashboard/cockpit modules. The latter two will provide extensive and consistent information across a number of assembly plants, and will be used to enhance the understanding of modularization originating from the interviews being conducted in the modularization and outsourcing project.

#### ***Outsourcing:***

We now collect a detailed inventory, not just of the components and subassemblies that are outsourced, but the reasons for outsourcing, who provides the components, etc. This allows us to take a more nuanced look at outsourcing. We continue to collect the information on "Standard" vs. "Non-Standard Activities" that distinguishes between activities done in house by most plants, and those activities that are generally done outside the plant.

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1 This team also includes Prof. Susan Helper, Prof. Mari Sako, and Ph.D. candidates Max Warburton and Sebastian Fixson.

2 Professor Kentaro Nobeoka is leading the Japanese team of researchers, which includes: Prof. Koichi Shimokawa, Prof. Akira Takeishi, Prof. Takahiro Fujimoto, and Mr. Oh -- Professor Fujimoto's graduate student.

### ***Build to Order:***

Many car manufacturers are exploring ways in which they can shorten the lead time between a customer's order, and vehicle delivery. The manufacturing process is often cited as a bottleneck in shortening this lead-time, and we have new questions that capture in detail those activities that help plants improve their response times to customer orders. For example, we have developed questions to understand lead-times at both the plant and its suppliers for various options based on complexity, the allocation process of vehicles to orders, the use of special work and holiday arrangements to permit systematic customer response times, and so forth. Researchers from ICDP and the 3-Day Car project have collaborated with us on these questions.

### ***Knowledge Diffusion***

A real difficulty that many OEM's are facing is how to transfer learning, not just from other OEM's to their plants, but the more basic question of how to diffuse best practice among their own plants. We have developed a number of questions relating to top management team career paths, formal information sharing arrangements between plants, the identification of "model" plants, and the transfer of personnel between facilities, to help us understand how knowledge diffuses across and within OEMs.

### ***Capital Productivity***

Traditionally, the International Assembly Plant Study has been concerned with labor productivity. We have worked closely with engineers at ABB to develop questions that enable us to develop a more systematic assessment of the capital intensity of the plants. This is particularly important given that we observed in Round 2 that plants were "buying" labor productivity via heavy capital investments.

### ***Environmental Performance***

We worked closely with other IMVP researchers to adapt the key components of the environment survey for use in the assembly plant study, with a particular emphasis on extracting the key elements that help define environmental performance.

As we developed draft questions for the new survey, we met with representatives from OEMs in the U.S., Europe, and Japan to receive detailed feedback. We also set up a web page to allow access to the draft survey for the international research team and for interested IMVP sponsors. This site enabled the large number of academic participants to provide feedback, and to comment on the feedback provided by others. An extensive amount of time was spent streamlining questions, and reaching consensus across the research team as to what should be included in the survey.

### **Next Steps:**

We are preparing cover letters for all the participating plants and companies, and expect the bulk of the surveys to go out in July. A few plants have already received the electronic copy of the survey and are filling it out. The Japanese and Korean research teams are finalizing translations of their surveys and will distribute them when these are finished.

While it is difficult to predict the speed with which surveys come back, we expect to be able to provide the following at the October meeting: A detailed overview of the new survey and its aims, a very

preliminary look at the productivity trends, and initial analyses of a subset of the new topic areas covered in the survey. We will work closely with the modularization and outsourcing team to find ways to link data from the assembly plant study on those topics with the field work undertaken by that point.

## **Publications During This Past Year:**

Pil, Frits K. and John Paul MacDuffie. (accepted for publication). "What makes transplants thrive: Managing the transfer of 'best practice' at Japanese auto plants in North America." *Journal of World Business*.

### *Extended form:*

Pil, Frits K. and John Paul MacDuffie (1999 forthcoming) "Transferring Competitive Advantage Across Borders: A Study of Japanese Transplants in North America" Jeffrey Liker, Mark Fruin, and Paul Adler, *Remade in America: Transplanting and Transforming Japanese Production Systems*, Oxford University Press.

Pil, Frits K. and Takahiro Fujimoto (1999). "The Dynamic Nature of Organizational Models." *Proceedings of the Forty-Eight Annual Meeting*. Madison, WI: Industrial Relations Research Association.

Pil, Frits K. and John Paul MacDuffie (1999). "Organizational and environmental factors influencing the use of high-involvement work practices." In Peter Cappelli, ed., *Employment Strategies: Understanding Differences in Employment Practice*, Oxford University Press.

Pil, Frits K. and Saul Rubinstein (1998). "Saturn: A different kind of company?" In M. Boyer, S. Tolliday, U. Jurgens, and E. Charron, eds. *Hybridization of Production System*, Oxford University Press.

### Other Presentations:

Frits submitted a symposium proposal to the Industrial Relations Research Association for January 1999. This proposal was accepted, and included his work with Taka Fujimoto entitled "The Dynamic Nature of Organizational Models", a paper by John Paul, entitled "Eisenach -- The Transformation and Evolution of a Model Facility" and a paper by Saul Rubinstein on the evolution of Saturn. The purpose of the symposium was to elucidate how "model" companies and plants have evolved over time.

Pil, Frits K. "Japanese production methods revisited -- exploring the adoption, diffusion, and evolution of superior manufacturing systems." Presented at the Inaugural Conference of the Center for International Research on the Japanese Economy, Tokyo University, Tokyo, September 1998. Paper also presented at the Institute for International Economic Studies (Toyota Research Institute), Tokyo, Japan.