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Bring your suppliers into your projects—Managing the design of work packages in product development

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Abstract

Early supplier involvement and integration is important in product development on strategic as well as on operational, project and team levels. Saab Aerospace intended to achieve early supplier involvement and high level of integration on all levels in the redesign of the aircraft JAS 39 Gripen. The research underlying this article shows that the intended strategy was only achieved on the strategic level and not on the operational project and team levels. One major reason for this was that the design of the work breakdown structure (WBS) and work packages (WP) in the product development followed the functional and departmental logic within each company resulting in incompatible structures and preventing communication and information exchange. This article intends to explore how prevailing functionally designed WBS and WP structures created barriers and to demonstrate how supplier integration can be improved by designing collaborative WBS and integrated WP. The Dependence Structure Matrix (DSM) is introduced in order to analyze, visualize and manage interdependencies and information exchange between Saab Aerospace and its supplier on different levels of the WBS and in different phases of the development process, following the logic of interdependencies and information flow, in order to support a strategy focusing on integration of suppliers on the project and team level.

Keywords: Supplier integration; Collaborative product development; Integrated product development; Dependence structure matrix; DSM; Concurrent engineering

1. Introduction

One major reason for the success of Japanese companies in general is their competence in collaborating with suppliers. The Japanese lean production system uses a small number of suppliers (Womack et al., 1990; Womack and Jones, 1994), who have responsibility for larger modules, are involved in the product development work more intensively, at an earlier stage and continues through the product life-cycle. The Japanese way of working with suppliers requires a high level of integration between the supplier and the systems integrator (Lamming, 1993). Some empirical evidence suggests that Japanese suppliers perform four times more engineering work for a specific project than US suppliers, while Europeans are somewhere in between (Clark and Fujimoto, 1991). For this reason, the potential benefits of strategic alliances with suppliers have received considerable attention (Bonaccorsi and Lipparini, 1994; Fruin, 1992; Lamming, 1989, 1987, Lyons et al., 1990; Quinn, 1992). The incorporation of suppliers into a firm's development process is considered a major key to a shorter development cycle and better products (Clark and Fujimoto, 1991; Backhouse and Brooks, 1996).

In the aerospace industry many aircraft corporations manufacture only 20–40% of the components and systems in an aircraft themselves; suppliers are responsible for the rest. In the Swedish commercial aircrafts Saab 340, Saab 2000, and military aircraft JAS39 Gripen, approximately 80% of the total manufacturing costs are related to purchasing goods from suppliers (Börjesson et al., 1996; Danilovic, 1997, 1999). Research by Weiss et al. (1996) indicates that the situation in the aerospace industry is similar to that in many other industries, requiring a high degree of supplier involvement in the development process based on long-term relations and early supplier

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involvement in design and development teams, joint risk identification and risk sharing, as well as joint target costing. Some results indicate progress in terms of:

- Locating design-build teams at the customer's site reduced engineering changes by 50% and cycle time by 25%.
- An enhanced cross-functional character of the workforce led to a decrease in the number of job descriptions for engineers from 103 to 30.
- Integrated product teams, products, and process resulted in significant improvements in quality, cycle time, and change orders. The post release engineering charge rate decreased by 96%.
- 50% less labour has been used to procure four times the number of parts, while maintaining high quality (Weiss et al., 1996).

During the eighties, Boeing developed a wide-bodied jet aircraft, the Boeing 777, based on ideas of concurrent engineering, establishing 238 cross-functional teams to work on the development program. The suppliers were involved in the concurrent process. Boeing was the technical systems integrator and introduced concurrent engineering among its suppliers by applying pressure to the supply chain. However, researchers indicate that in practice this close systems integrator–supplier collaboration is less evident than what could be expected. Klein and Susman (1995) claim that

> [s]ince a large percentage of aircraft component parts are purchased, supplier involvement in the product development process is critical. But only 18 of the 63 teams (23%) include suppliers, either full- or part-time (Klein and Susman, 1995, p. 17).

The finding from Klein and Susman (1995, p. 5) show that in the US aircraft industry, integrated product teams are used mostly in the engineering phase of the product development (58%), followed by demonstration and validation (13%), and pilot production (7%). This may be due to the long product development cycles. In this situation, it takes several years to achieve the mature stage of the development process. It is interesting to note that the initial phase of concept exploration, only 2% is conducted in cross-functional team settings!

This empirical observation in the aerospace industry raises important questions. If we know that a suppliers' involvement in the process of product development is important and if it leads to substantial positive outcomes, why is there a discrepancy between the arguments for increasing supplier involvement and the empirical observations indicating a low level of early involvement and supplier integration across many development phases from concept to production and sustain engineering? Further questions can be raised of how suppliers actually were involved in the development process in these teams indicating a low level of involvement. Were they only observers, guests, or did they work as full team members? We can also ask whether the division of work between suppliers and systems integrator was mutually beneficial or a contradiction, whether they had the same mission and goal in teams, and how workflow and organizational routines enhanced or obstructed the team-based work.

1.1. Supplier integration in the development of Saab 39 Gripen

The Swedish aircraft manufacturing company Saab Aerospace AB has been developing military aircraft since 1937 and has provided the Swedish Air Force with many different aircraft. JAS39 Gripen is the first aircraft in the new fourth generation of military aircraft such as the French Rafale, the US F-22 and the European Eurofighter 2000. Approximately 3500 people are employed at Saab in the development and production of military aircraft. Notably, Saab Aerospace is one of the smallest manufacturers of high-tech military aircrafts in the world developing and producing one of the most advanced aircrafts. There are only 3–4 competitors on the world market.

The characteristic of the Gripen is its capability to combine the roles of traditional fighter, attack, and reconnaissance aircraft. This combination of tasks creates great flexibility. To ensure flexibility and to accelerate field service, the JAS39 Gripen carries an auxiliary power unit (APU). This consists of a small jet engine turbine installed in the rear airframe, which produces air pressure for engine start, the electronics cooling system, and the emergency electrical and hydraulic power system. The complete system is named APESS–Auxiliary Power Engine Starting System. Initially, the Gripen was designed to carry an APU developed and manufactured by Microturbo in France. However, due to new environmental requirements established by the Swedish government, a new APU had to be developed. After a period of discussions between Saab, Microturbo in France, and Sundstrand in USA, a decision was made at Saab that a new APU should be bought from the US supplier, Sundstrand. Due to a very demanding time schedule, a concurrent engineering approach had to be adopted in the development project. The strategy of Saab was to move towards long-term oriented partnership collaboration on all corporate levels. On the strategic level Saab and the supplier agreed to work in an integrated way.

Several measures to ensure integration with the supplier were taken. A special liaison engineer was located at the supplier for the whole timetable of the project, numerous meetings took place between people at Saab and at Sundstrand, especially among management, special facsimile lines were introduced to enhance secure communication, and mutual adjustment points were scheduled in order to evaluate the progress of the project. Several Saab engineers were sent over to the supplier to coordinate work and occasionally some engineers from the supplier spent time at Saab. However, on the operational, engineering level the desired integration was not established. The