

## Summary

Product development is of great concern to many companies: this can be summed up in the catchphrase *“Innovate or die!”* Long-term profits, growth, changing needs of customers, competitors, and technological progress are some of the frequently cited reasons for the importance of companies of developing new products. Development of a company’s network of relationships is also of great concern to many companies: *“No business is an island”*. Such relationships are frequently referred to as partnerships, strategic alliances, coalitions, etc. The network of relationships that surrounds a company tends to show a high degree of continuity. The network restricts the company in many ways, but also provides it with numerous opportunities.

A company can choose to view product development and the development of its network of relationships as two separate processes. For a company, this may seem a good idea. In this manner, it can focus on how to conduct product development in the best possible way in one setting, whereas it can focus on how to develop its network of relationships in the best possible way in another setting. But what if the company discovers that, to develop a product, it also needs to develop relationships with two suppliers and one customer? Or that a product it developed together with a customer a long time ago led to investments in new design facilities that now come in handy for solving some technical difficulties in a supplier relationship? Such a discovery may convince a company about the appropriateness of, at least sometimes, viewing product development and the development of its network of relationships as connected processes.

For a company, there are several reasons for attempting to connect the two processes of product development and the development of its network of relationships. By opening the way for relationships with other companies during product development, a company opens itself up to fresh eyes. After all, relationships are known to create the potential for a variety of solutions in relation to product development, as different knowledge bases are confronted. In particular, customers with a superior insight into the needs of the market, so-called “lead-users”, are recognized as possessing valuable knowledge. Some relationships benefit product development because they provide access to complementary technologies and know-how outside the company. The company may make use of its network of relationships when conducting product development in order to specialize, e.g. by outsourcing the development of parts of the product. Through connecting the development of its network of relationships with product development, the company also takes into consideration the importance of making its products useful to other companies. After all, product development seldom leads to success due to the technological superiority of the product itself. Rather, a product that is developed has to be made useful by others, a factor that again draws attention to a company’s network of relationships. By choosing to view these processes as connected, a company also increases its opportunities to influence the extent to which these processes become connected. The thesis views these processes as connected.

To the extent that academics have sought to connect these two processes, and also as they are illustrated above, relationships have been viewed as tools that

are helpful to product development. However, this thesis takes a radically different point of departure by raising the research question: “*How can a company through product development influence the development of its network or relationships?*”

The industrial network approach as presented by the IMP Group provides the theoretical foundation for this thesis. Within this research tradition it is a basic concept that the company is part of a network of relationships. The industrial network approach presents a view of product development as a process that exceeds company boundaries and involves this network of relationships. Product development and the development of relationships are therefore viewed as connected processes within the industrial network approach.

Within the industrial network approach, the *four resource entities model* represents a way of connecting the two processes of development of products and of relationships. The four resource entities consist of products, facilities, relationships and business units. The model depicts how these four resource entities develop through interaction with each other. So far, the model has mainly been used in order to provide insight into technical development. In this thesis, the four resource entities model is used to create insight into how product development influences the development of relationships.

Nordic VLSI, a company located in Trondheim, Norway, is the focal company of the thesis. The thesis is based on single-case study research, and takes development of products for seven of Nordic VLSI's customers as the point of departure. Nordic VLSI develops ASICs (Application-Specific Integrated Circuits), that is, customized data chips. These products are integrated into the following products by Nordic VLSI's customers: (1) SensoNor: sensors for airbag- and tire-pressure purposes, (2) VingCard: locking systems for doors, (3) Nobø: central controls for heaters, (4) Vingmed: ultrasound equipment, (5) Q-Free: electronic toll collection systems for vehicles, (6) CelsiusTech: sensors for measuring the distance between vehicles, (7) SPT: data converters for a variety of purposes. Product development for each of the seven customers entails the development of a number of relationships. The case is based on a total of 33 one-on-one interviews with staff of Nordic VLSI and the seven customers, as well as various secondary sources of information.

On the basis of the four resource entities model, *five* conceptually different ways are identified in which Nordic VLSI through product development influences the development of its network of relationships. As Nordic VLSI develops a product for a customer, this influences the development of a relationship between the two companies. However, relationships with other companies are also often involved in the development of a product, e.g. suppliers to Nordic VLSI, or the customer's customer. The development of the product also influences the development of these relationships. The first of these conceptual ways concerns how Nordic VLSI through the development of a product influences the development of relationships *directly*. As Nordic VLSI develops a product, this also influences the development of its network of relationships in indirect ways. As an example, the development of a product for a customer may influence a facility for Nordic VLSI. In turn, this facility may influence the development of Nordic VLSI's relationship with a supplier. Each of the latter four of these conceptual ways concerns how Nordic VLSI through development of a product influences the development of relationships *indirectly* through one of the four re-

source entities, i.e. a relationship, business unit, product or facility. Identification of the indirect connections between the development of products and of relationships can be particularly difficult. At the same time, whenever the development of a product influences the development of a relationship, particular characteristics of the product that is developed may influence particular characteristics of the relationship that is developed. In this thesis, such characteristics are discussed in order to simplify the investigation of how the development of the product influences the development of relationships.

The five conceptual ways provide a framework for a company to use in understanding product development and the development of its network of relationships. With this framework, the time dimension becomes of interest to a company. After all, the development of a product may, subsequent to its completion, influence the development of a company's network of relationships. For a company, therefore, the effects that follow product development are by no means clear-cut and easy to define. This draws attention to the visibility of these effects for a company, i.e. to what extent it is able to expect these effects, and to observe them retrospectively. For a company, visibility is important in order for it to create and utilize these effects.

The framework provided in the thesis has implications for some common challenges related to product development. For a company, whether or not to develop a product has traditionally been looked upon as a single decision where the product, with corresponding development costs and sales revenues, represents the all-important effect. By following the framework provided in the thesis, on the other hand, the possible effects on a company's network of relationships should be taken into consideration when deciding whether or not to develop a product. For the company, the visibility of these effects is likely to increase over time. Therefore, whether or not to develop a product becomes not a single decision, but rather an issue a company must reconsider during the development process. In the same way, development of a product has traditionally been looked upon as successful when the sales revenues exceed the development costs. By following the framework provided in this thesis, on the other hand, the development of a product can influence the development of a company's network of relationships in a positive or negative way. Naturally, this should be of interest to any company, both when planning how to develop a product, and when looking back in order to determine whether or not the development of a product was successful. Determining the stage at which the company should undertake this review of the product's success is also a challenge.

The importance of visibility has been noted in relation to how a company through product development can influence its network of relationships. However, a company can do so much more than merely expecting and observing these effects: they do not simply occur according to a predetermined pattern. On the contrary, a company is a participating actor that at least in part determines which relationships are to be influenced by the development of a product, and in what way. The framework provided in this thesis may help companies to improve the visibility of the effects of product development on their network of relationships – a complex and confusing area to manage without signposts or guidelines. By confronting the issue of visibility, a company may strive to create and utilize effects from product development in order to develop its network of relationships.