

Dynamic Contract Extension in Supplier Development

Since manufacturing firms increasingly focus on their core business activities, an efficient supply chain plays a major role in generating competitive advantages. However, suppliers too often lack the capability to perform adequately. In response, manufacturers across a wide range of industries are implementing supplier development programmes to improve supply chain performance. Supplier development is defined as any effort by a buying firm to improve a supplier's performance and/or capabilities to meet its short- and/or long-term supply needs.

In an increasingly dynamic marketplace, businesses are expected to change faster and often these innovations come from suppliers. But few have mastered the art of developing suppliers to drive forward business competitiveness. Supplier development is about generating a new capability or competency in suppliers. It is often linked to, although distinct from, performance improvement. By developing suppliers, organizations can generate competitive advantage. This can manifest itself in a new product for sale, a new streamlined process or the implementation of a new standard. Suppliers are an enormous – and often untapped – pool for innovation, continuous improvement and cost reduction. By enabling this potential, companies can enjoy an enormous impact on the bottom-line.

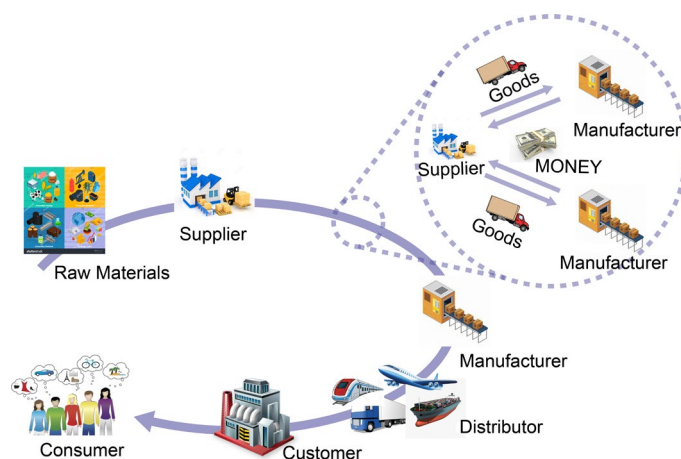
Supplier development consistently requires relationship specific investments. In accordance with the relational view activities of supplier development require relationship-specific resources in order to develop supplier through investing money, improving people skills, or managerial knowledge.

The relational perspective is highly based on informal contracts. The main advantage of informal agreements is that there are no specific formalities or expenses in concluding these agreements.

Problem Definition

In the supplier development context, engaged parties have to decide between formal contracts which represent a protection against opportunism, and relational contracts, which rely more on a mechanism to enhance successful exchange. While beneficial for both the supplier (improving performance or capabilities) and manufacturer (meeting supply needs), supplier development requires a long-term relationship. In the current market situation, which is characterized by ambiguity and rapidly changing demands, companies introduce concepts from Industrie 4.0 and Industrial Internet of Things to appropriately react to these changes.

The concepts, however, require high flexibility which may be hindered by long-term contracts regarding supplier development. Long-term contracts may not provide maximum flexibility for the members to take advantage of dealing with turbulent environment. As a consequence, the tool of supplier development may be ruled out as an option for innovation and improvement. This may pose an obstacle for the development of Industrie 4.0 and the innovative capacity in particular for the German economy, which is heavily based on small or medium sized companies.



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Research Question

This project will answer to the question, what will be the optimal contract period to maximize the overall profit and minimize the contractual drawbacks?

The aim is to provide decision makers in procurement and supply chain management departments with a method to render supplier contacts more profitable and flexible at the same time. We propose a receding horizon control scheme to mitigate possible contractual drawbacks, while significantly enhancing the supplier development process and, thus, to increase the overall supply chain profit.

Solution Approach

The trend to utilize mathematical models in general and control theory in particular in decision-making within supply chains is clearly visible. Here, model predictive control (MPC), also termed receding (rolling) horizon control, plays a predominant role due to its ability to deal with nonlinear constrained multi-input multi-output systems on the one hand and its inherent robustness on the other hand. Consequently, MPC is a well-established strategy to deal with uncertainties in supply chains.

MPC is an advanced method of process control and used to control processes while satisfying a set of constraints. In this project, MPC is first used in supplier development to reduce possible contractual drawbacks by dynamical extending the contract.

Abstracting from an analytical method, the idea of using a receding horizon control technique in this setting is to mitigate the possible contractual hazard of inflexibility by replacing a single long-term contract by a series of short-term contracts. The procedure of receding horizon control is given by three steps:

- Measuring the current learning effect of the supplier of the system,
- Computing an optimal supplier development strategy over a finite time horizon, and
- Implementing only the first part of that strategy, which renders the method to be iteratively applicable.

To this end, we model a realistic setting: Firstly, we will consider uncertainties in the dynamics of the problem. Secondly, we will address the issue of partner opportunism by considering multiple manufacturers, and allow for a completion of the analysis of the supplier development setting properties.

In particular, we want to consider short contract periods, which still render supplier development to be profitable within the contract period, while a renewed contract will result in an extended period of supplier development and therefore a higher overall profit of the supply chain.

