Introduction

High customer demand causes that modern companies should always have enough products available to be able to comply with product demand. This means that businesses have a strong incentive to be aware of demand patterns (Forslund et al., 2007). The uncertainty in customer demand can be reduced by an effective forecasting of future demand. Demand planning can therefore be recognized as a key activity which plays an important role in the organization. Recently demand planning shows to become even more important (CapGemini, 2007).

Planners mostly use historic sales data and market intelligence to formulate the forecast. Together with other departments, like commercial or logistics, these forecasts are transformed into demand plans which are the input for the production planning. Literature shows that companies often face difficulties to comply effectively with customer demand (Catt, 2008; Thonemann et al., 2002; Syntetos and Keyes, 2009). Tersine and Toelle state in their article on optimal stock levels that ‘many organizations find themselves in a situation where inventory levels are excessive’ (Tersine et al., 1984). One of the reasons for this situation are the complex and diversified product portfolios most companies have today (Thonemann and Bradley, 2002). Other causes can be found in the volatile markets and demand patterns, and fierce competition.

If an organization achieves to have an effective demand planning process, in the sense of response to customer demand, it provides them a competitive advantage. High service levels are preferred in order to keep the customers satisfied and perform better than the competitors (Reid and Sanders, 2005; Gumus et al., 2009; Catt, 2008). Because demand planning is not able to produce always a hundred percent accurate forecast inventories are necessary to achieve a high customer satisfaction. This is confirmed by Yu who states that ‘uncertainties in a production
distribution chain are usually buffered by inventories’ (Yu et al., 2001, p. 114). In this way customer service levels could be high because the desired products are directly available for the consumers. Inventories however are capital intensive. Minimizing inventory in response to the need for capital is therefore another important objective organizations have (Coyle et al., 2003). Demand planning should cope with this dual objective in both cost reduction and customer satisfaction. As an important element in the Supply Chain the demand planning process has impact on the functioning and the effectiveness of the entire Supply Chain. This is confirmed by John Hellriegel who states that ‘demand planning, as a means to forecast accuracy, is now widely known to be a key driver of business performance’ (Hellriegel, 2009, p. 12).

The effectiveness of demand planning is not only affected by external factors like customer demand or market conditions. In demand planning there are also some other factors to consider. Factors often mentioned in literature are the design and configuration of the supply chain and its supporting processes, and the focus on information sharing between them (Forslund et al., 2007; Thonemann, 2002). The internal processes of an organization could really disturb an organization’s output if they are not functioning optimal.

**Problem**
Several attempts can be found in literature to resolve these situations and increase performance. Recently renewed interest in demand planning resulted in additional studies on the improvement of demand planning. Improvements often can be found in the introduction of it-systems, planning tools, enhanced communication, or increased market visibility (Thonemann, 2001; Cachon, 2000; Ferbar et al., 2009; Smaros et al., 2003). These attempts show however to be primarily focused on single aspects of demand planning. An integrally vision towards the demand planning process, considering the whole system, context, and external factors is often missing.

Therefore this paper discusses the effects of a systems-approach towards the improvement of the demand planning process to achieve better operational results. The following research question is formulated to gain more insight in this phenomenon:

‘What is the effect of a systems approach on demand planning improvement and how does this relate to increased performance levels?’

The goal of this paper is to contribute to the current scientific knowledge by applying a scientific approach and models to an existing business situation. In this way the effect of a systems-approach is discussed.

**Methodology**
This paper is written based on a case study approach which is executed at a production firm. This organization is active on the pharmaceutical market and faces difficulties in achieving an effective forecasting process. As a result local performances are low and costs are increasing. The case study is executed based on desk research, interviews with the involved stakeholders, and data analysis.

First the systems approach will be introduced which is the leading focus on the subject. Second the role of the demand planning process in the organization will be discussed based on a logistical framework. This results in an overview of the context and the root causes under the problematic performance levels related to demand planning. Based on this system diagram some improvements are discussed and what their effect on the organizational performance is. This paper ends with the conclusions and a description of the practical and scientific relevance.

**Systems approach**
The systems approach from which this article is written, is based on the notion of a system
as ‘a whole composed of elements that are related to each other. That cohesion will emerge from the fact that the elements are linked together by their relations’ (Haaf et al., 2002, pp. 53). An approach which relates to this is the logistical model of Visser et al. (2009) which gives a visualization of the interrelation and dependence in the corporate strategy, goals and performance measurement in the field of logistics, see figure 1.

Role of demand planning in the organization
In the light of the logistical model of figure 1 demand planning is a central activity in the Supply Chain which is interrelated with several business aspects.

Strategy
The strategy of an organization defines on a high level the general set-up of the logistical structure and how processes are designed within. Organizations can among others decide to either focus on costs or customer service. The strategy therefore has impact on the demand planning process where the main drivers for performance relate to costs or customer service levels. This has impact on the way the demand plan is made.

Processes
There is a direct impact of the goals and objectives of a company on the logistical structure and the design of business processes. Often the organizational strategy leads to a one-sided translation of goals into business processes. Therefore unbalanced business results are achieved, where either the customer focus leads to high service levels (and inventories), or a cost focus leads to low inventories, but lower service levels.

Support and Control
The support and control of the business processes is often done by management. The management of business processes has effect on the outcome and effectiveness of the processes. The importance and impact of these organizational factors and governance is addressed by several authors (Hendrikse 2003, Meijer 2008, Powell 1990). They show that the type of governance closely relates to the organizational structure of an organization. The alignment between these factors has impact on the effectiveness and the performance of an organization.

Information
Support and control has a tight connection with information management. Sharing information through forward and feedback
communication structures is important. Examples of an attempt to focus on enhanced cooperation are developments in Sales and Operations Planning (S&OP) (Ruggles, 2009; Cecere, 2008). S&OP is described as ‘the process by which we bring together all the plans for the business (customers, sales, marketing, development, manufacturing, sourcing and financial) into one integrated set of tactical plans’ (Milliken, 2008). In this way information can be shared to come up to better demand plans.

**Personnel organization**
The personnel organization defines which persons are responsible for which tasks or goals. This relates to the communication structures and the logistical organization. To come to an acceptable demand plan the planning department should be equipped with the right persons and have tight relationships with other stakeholders in the planning process.

**Performance measurement**
Measuring performance within an organization strongly relates to the corporate strategy and goals. As described before a focus on costs will lead to performance indicators which are aimed to satisfy these cost factors. On the other hand there is the focus on customer satisfaction which leads, from a logistical perspective, to kpi’s which are focused on maximal service levels and customer satisfaction. In this way performance measurement has also a direct effect on the functioning of the demand planning process. During the planning process choices are made and goals are set to achieve depending on the focus in performance measurement.

**Demand planning system**
Through the application of the logistical model to a real business situation a description of the context of the demand planning process can be made. Through a systems diagram the external and internal factors can be addressed. This is shown in the systems diagram in figure 2.

The diagram shows the context and the internal root causes in the demand planning system. These factors have effect on the level of forecast accuracy and though on the organizational performance indicators.

The external factors are related to the Supply Chain (location of customer order decoupling point, flexibility, logistical system) and market characteristics like: product demand, quality requirements, and regulation.

The main instruments for an organization to influence the demand planning performance

![Figure 2, System diagram](image-url)
are information management and the planning quality. Both factors contain aspects which can be classified as root causes. These root causes are concrete factors on an operational level which have impact on the performance of the demand planning process. Related to the organization aspects, the identified root causes are the type of governance, performance measurement, communication, and accountability. The root causes for the planning quality are the forecasting methods, the planning horizon, and the product differentiation.

Optimizing the demand planning process it should be kept in mind that in the context of the demand planning process there are factors related to the Supply Chain and market aspects which also have impact on the functioning of the demand planning department.

**Improvements**

Improving the current demand planning process can be done by considering the potential improvements in the root causes which are defined. Both instruments in information management and forecasting quality can be considered on their effect and impact on the organizational performance. The case study showed that potential improvements would have most impact on the operational performance of the demand planning activities by the following aspects:

- Quantitative forecasting
- Performance measurement
- Process design

The quantitative forecasting methods shows to have the biggest contribution to an increase in forecast accuracy. In contrary to the other factors this effect on performance can easily be quantified and measured. The case study shows a potential increase in forecast accuracy in some cases of more than 18 %.

Next to more quality in forecasting measuring performance is also an important aspect. By redesigning the performance measurement structure the information management and communication can be improved. Other, more balanced, indicators show to reduce the amount of uncertainty and disruption in the forecasting process. Better goals and measurement methods are the result of the introduction of a balanced measurement method. A model like the balanced scorecard method, as identified by Kaplan and Norton (2001), can be beneficial. By the stronger focus and awareness of a balanced set of indicators on performance measurement the performance levels will increase.

Another set of improvements can be formulated for the process design. The organizational and procedural aspects have most impact on the uncertainty in the demand planning process. The root causes in these factors cause uncertainty and distortion of information and processes which has a negative effect on the forecast. Improvements can be formulated for the design of the processes and the communication structure. An improvement in the case study was making the demand manager more accountable for the outcome of the process. Also he should take more ownership of the process and actively communicate with all stakeholders on the current status. Furthermore a restructuring of the processes into one shared consensus-meeting in which all relevant stakeholders are involved is advised. This will be beneficial because in these meetings a shared attitude towards an optimal forecast accuracy can be achieved in stead of sub-optimization for each involved department.

**Introduction and effect**

From the systems perspective it follows that these improvements would have the most effect through an integrated approach. The introduction of quantitative forecasting shows to be beneficial for the organization by its contribution to a forecast accuracy increase of more than 18 %. This result could however only be realized in practice if the process improvement is approached from a systems-
Next to these new forecasting methods uncertainty has to be reduced in the planning procedure. Through this uncertainty reduction and optimization of the communication structure the quantitative forecasting models would have maximum effect. This organizational redesign improves the way information is transferred and controlled through the organization and optimizes the procedure to come to a demand planning process which is more focused on forecasting of the correct customer demand instead of sub-optimization of the demand plan for each stakeholder’s own goals.

Conclusions
This paper shows that the application of a systems vision leads to a beneficial approach in organizational performance improvement. Analyzing the demand planning process from a systems perspective resulted in several findings which are an answer to the research question.

- It appears that a system diagram helps to place an organizational process into its context. It also provides insight into the steering variables to influence the system.
- Analyzing from a systems approach leads to a set of improvements (based on root causes) which can be optimized to come to better performances.
- The formulated improvements in itself are not new. However the approach to integrate these improvements to a single design is a different and beneficial approach. The insight on both the individual but also the shared contribution of the improvements to performance is most important.

Applicability
The results in this paper are obtained from a case study in a real business environment. Therefore, in first instance, the results have a limited validity for other organizations. However these results may be generalized to other organizations because of some general aspects and commonality in these problems. Several organizations face the same complexity in improving organizational performance. This paper shows that the systems approach towards these problems will contribute to increased performances.

Relevance
The study contributed to the improvement of a specific business situation. The scientific relevance in this lies in the fact that the article shows that a systems approach will have additional value in organizational redesign in order to achieve higher performance. In current literature this systems approach towards the improvement of a single business activity is often missing. This article shows that such an approach would lead to additional positive effects, because not only the individual (theoretical) improvements are considered but also the interrelations and effect on each other. Based on this it can be defined how to come to an integrated and most effective approach.
References

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