The development of a reengineering approach using the business process reengineering cycle, based on key performance indicators

van Heijst, T.M.M.

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The development of a reengineering approach using the business process reengineering cycle, based on key performance indicators

by

T.M.M. van Heijst

BSc Industrial Engineering and Management Science TU/e (2010)
Student identity number 0536556

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Supervisors:
dr.ir. R.M. Dijkman, TU/e, IS
dr. P.M.E. Van Gorp, TU/e, IS
dr. B.H.J. van Dijk , Ahold, AIL

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Abstract

This study takes the business process reengineering cycle (BPRC) as a starting point to develop a reengineering approach based on key performance indicators. This model contains the fundamental steps of a reengineering methodology. The BPRC consists of four steps but due to time limitations only the first three steps will be defined. To test and validate the BPRC, a case study is carried out at Ahold Inbound Logistics.

Step one is about identifying the as-is processes. For this purpose, existing documentation should be analyzed and interviews should be conducted. Process models of the as-is situation can then be modeled using BPMN.

In step two, the as-is processes are analyzed using key performance indicators. These are gathered in two brainstorm sessions. One session has a process orientation where the starting point is a set of existing processes. The other workshop is dimension oriented since performance measures are commonly classified by dimensions in literature. The KPI's are then recorded using a performance measurement sheet.

In the third step, to-be processes are designed. By applying best practices found in literature, process improvement suggestions are proposed.

It turned out that this approach works well for an environment like AIL. Although, this research lacks the implementation phase so no conclusions can be drawn on the real applicability of this approach.

Preface

This report is the result of my graduation project to obtain the degree of Master of Science in Operations Management and Logistics at Eindhoven University of Technology. The case study is conducted at Royal Ahold N.V. at the department Ahold Inbound Logistics.

I wish to express my gratitude to the following people.

First of all I would like to thank my first supervisor, Remco Dijkman for his helpful input and feedback, and also the patience that was needed sometimes. I enjoyed our meetings and discussions which gave me new insights and helped me to keep structure. Next I would like to thank Pieter van Gorp, my second supervisor for his contribution to and feedback on my report.

I am very grateful to all the people at Ahold Inbound Logistics that helped me during the project and made time available for my research project. A special thanks goes to Bert van Dijk, director at AIL for giving me the opportunity to do my thesis project at his department. I really enjoyed my time at the department.

Finally I would like to thank my family and friends for the support and good times along my studies.

Thimo van Heijst

Eindhoven, 2011

Management summary

This study looked at the application of the business process reengineering cycle, based on key performance indicators. Activities per step of the cycle are determined and tested, conducting a case study at Ahold Inbound Logistics where the focus was on business process modeling, KPI determination and application of best practices. This research helped to answer the research question:

How can the business process reengineering cycle, based on key performance indicators, be equipped to improve the performance of operational processes?

This question is answered by using insight from literature, developing a method and by testing this method in a case study. Many step-by-step plans for reengineering exist in literature. The business process reengineering cycle consists of the fundamental steps and is used in this research. The analysis part is based on key performance indicators. The BPRC consists of four steps. The first three steps are elaborated on but due to time limitations, the fourth step was outside the scope of this project.

The developed BPRC contains of the following steps and activities.

The determined activities for the first step, identifying as-is processes, are: 1. Identify processes, 2. Model the processes and 3. Validate the process models. This step worked well in practice. All common processes were identified, modeled using BPMN, and validated.

The second step of review, update and analyze as-is processes is carried out by determining and measuring key performance indicators. KPI's work well in measuring process performance but for a complete analysis of a process, other analysis techniques might be useful. The approach for determining the KPI's, workshops, worked well in practice and resulted in useful KPI's. It seems that the process oriented brainstorm resulted in more useful KPI's but this cannot be justified with data. The dimension way of thinking used in literature is a good way to classify KPI's but seems not practical for use in practice and should not be used solely.

The KPI workshops produced many KPI's of which 34 are listed as most interesting by the involved employees. Five KPI's are selected for the remainder of the study. These are:

1. % Deviation actual stock from planned stock
2. % Net service level per planner and category
3. # Emails per category
4. # Of messages in Navision per category
5. Throughput time ordering process

Furthermore the performance measurement recording sheet works well in practice and makes sure the KPI's are defined well.

Designing the to-be processes is step three of the BPRC. In this research this is done by applying best practices found in literature. These best practices give good guidance for suggesting improvements in processes. In practice many of them were not applicable, probably depending on the business environment and complexity of the processes. Out of the 29 best practices found in literature, only a limited set of eight practices, five frequently, is used. Notable is the frequent use of task automation, which one should be careful with. Automation seems like an easy solution but it requires standardization and the technology should be available and ready. Also the process should be optimal before automating a less than optimal process.

Overall, the proposed method works well for an environment like AIL: a small department with only little hierarchy, and short processes. Meaning the business process reengineering cycle, as limited as it is, and the activities per step are appropriate. This approach can be used for similar environments. Although the use of solely KPI's and or solely best practices might limit the result. The use of other or complementary techniques might be interesting and should be investigated.

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1 Introduction

In the area of business process reengineering, many methodologies for reengineering exist. In this research, a reengineering model will be suggested, based on key performance indicators, with the fundamental reengineering steps. For each step, activities will be defined. This model will then be tested in a cast study at Ahold Inbound Logistics (AIL). The operational processes found at AIL will serve as means to find and apply KPI's and best practices.

Section 1.1 explains the motivation for this research followed by section 1.2 which introduces the research question. The research approach can be found in section 1.3 and section 1.4 outlines the report structure.

1.1 Motivation for research

This section briefly introduces the topic of business process redesign, followed by the actual motivation for this research.

Business process reengineering emerged in the early 1990's. In those days, reengineering was defined as "the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance, such as cost, quality, service, and speed." (Hammer & Champy, 1993). Early consultants demanded radical change like Hammer (1990), which says to obliterate all non-value adding work from the process. Later, this radical or so called revolutionary approach changed to a softer evolutionary or incremental approach where the starting point is the current process (as-is process) instead of starting from scratch (clean sheet approach).

Many different terms relating to the management or improvement of business processes can be found in literature e.g. business process redesign, business process reengineering and business restructuring (Forster, 2006). They are all about enhancing business processes, however the level of change, starting point, frequency of change, time, scope, resources, expectations, and impact may differ. Curtice (2005) tries to capture these improvement efforts into three levels: incremental improvement, redesign and rethink. Figure 1 shows their impact over time.

In Incremental improvement the scope is small e.g. enhancing (a few steps in) small business processes. It will produce improvements quickly but the impact will be small. Redesign is aimed at bigger processes and involves a bigger project team. More time and effort will be needed but the impact will be bigger. Rethinking is concerned with the biggest improvements like outsourcing a whole process or department. These take the most time and the impact is big. It is important that the expectations of the project are right e.g. when major improvements are required, substantial change should be accepted. So when starting a BPI project, the approach should be based on the kind of improvement required. Apparently it is hard to give a general definition of BPR but basically it is about "…coming up with a new process design

that is in one or more ways superior to the existing plan." (Mansar & Reijers, 2005). In the remainder of this research, BPR will refer to business process redesign.

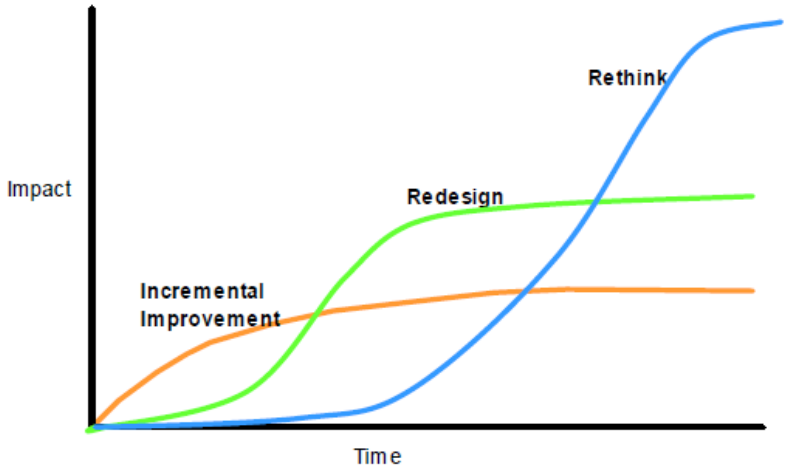


Figure 1 three levels of BPI (Curtice, 2005)

For structuring BPR projects, many step-by-step plans exist in literature. Muthu, Whitman, and Cheraghi (1999) consolidated five BPR methodologies into a new one with the steps: 1. Prepare for BPR, 2. Map & analyze As-Is process, 3. Design To-Be processes, 4. Implement Reengineered processes, 5. Improve continuously. Kettinger, Teng, and Guha (1997) did something similar by composing a stage-activity framework out of 25 BPR methodologies with the following stages: 1. Envision, 2. Initiate, 3. Diagnose, 4. Redesign, 5. Reconstruct, 6. Evaluate. Both consolidated frameworks contain more or less the same steps. Other methodologies found in literature also contain similar activities. It is interesting to compose a concise step-by-step approach for process redesign based on key performance indicators. This approach should contain the fundamental steps for which a certain set of activities per step will be determined. For this purpose, the steps of the Business Process Reengineering Cycle (BPRC) in figure 2 will be used.

Step one is the identification of current business processes. Step two is about reviewing, updating and analyzing the as-is processes. In step three the to-be processes will be designed. Finally in step four, the to-be processes will be tested and implemented. The purpose of this research is to determine a set of activities per step and test this in a case study. Due to time limitations, the scope of this research is limited to the first three steps.

For step one, a modeling language will be needed. For the analysis of the as-is processes, process performance will be measured using performance indicators. Finally, a redesign technique will be used for step three.

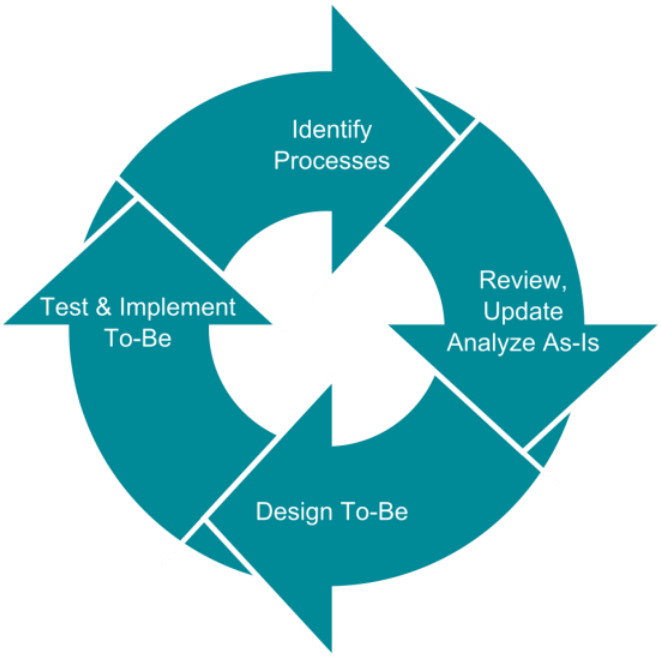


Figure 2 Business Process Reengineering cycle

1.2 Research question

The goal of this research is to formulate a redesign approach with a specific set of activities. The reasons for business process redesign are diverse. One of the reasons is to improve the performance of a process. To measure the performance of business processes, KPI's will be formulated. To improve the performance of the processes regarding these KPI's, best practices in process redesign will be applied.

This research will answer the following research question:

How can the business process reengineering cycle, based on key performance indicators, be equipped to improve the performance of operational processes?

The following questions need to be answered to answer the main research question:

1. **How can as-is processes be identified and modeled?**
2. **How can the performance of the identified processes be determined?**
   - How can performance indicators be classified?
   - What are the requirements for performance indicators?
3. **How can the identified processes be improved?**
   - Which best practices can be used to improve a selected KPI to the desired value?

1.3 Research approach

This section briefly explains how this research will answer the research questions. Full details on the exact approach can be found in chapter three. Figure 3 gives a schematic overview of the research approach.

1. - To redesign business processes, initial as-is process models are required. For this purpose, available documentation should be used and interviews should be conducted. The processes can then be modeled using an appropriate modeling language.
   In the case study, the operational processes of AIL will be clearly scoped and modeled using an appropriate modeling language. The models should contain at least the in- and outputs, the actors and the activities of the processes. The first source of information is the available internal documents. Internal documents available are: original manuals from the start up and a document in progress with process descriptions of a part of the processes within AIL. Because of the lack of data logging, models cannot be retrieved from logs.
   A second source of information is a set of interviews. Interviews are used to gather data on the actual execution of the processes and to check the correctness of the models afterwards. Employees from every role involved in the operational processes were interviewed, including: inbound logistic mangers, inbound logistic assistants, data specialists and planners.

2. - First, a common way to define performance indicators is obtained from literature. Second, brainstorm sessions are organized with planners and their team leader to acquire indicators of interest, specifically for processes of the planning department. From this list of indicators, five KPI's will be selected together with the director and team leader of planning.
   - With the use of literature a set of requirements for the KPI's for successful implementation will be composed.
   - For every performance indicator it will be determined what data is required and how it will be used. This is recorded in a performance measurement recording sheet.

3. - With the performance indicators in place, base measurements are carried out. The required data for these indicators is collected from the available sources and indicator values for the current performance are drawn up.
   - Based on the current performance, a target for improvement is set. The target should be set in agreement with the accountable employees of the concerning process and should be feasible and within a set timeframe.
   - Processes with the biggest impact on the defined KPI's are selected. Best practices found in literature will be used for improving the KPI values of the selected processes. Based on the results, improvements for the processes are proposed.

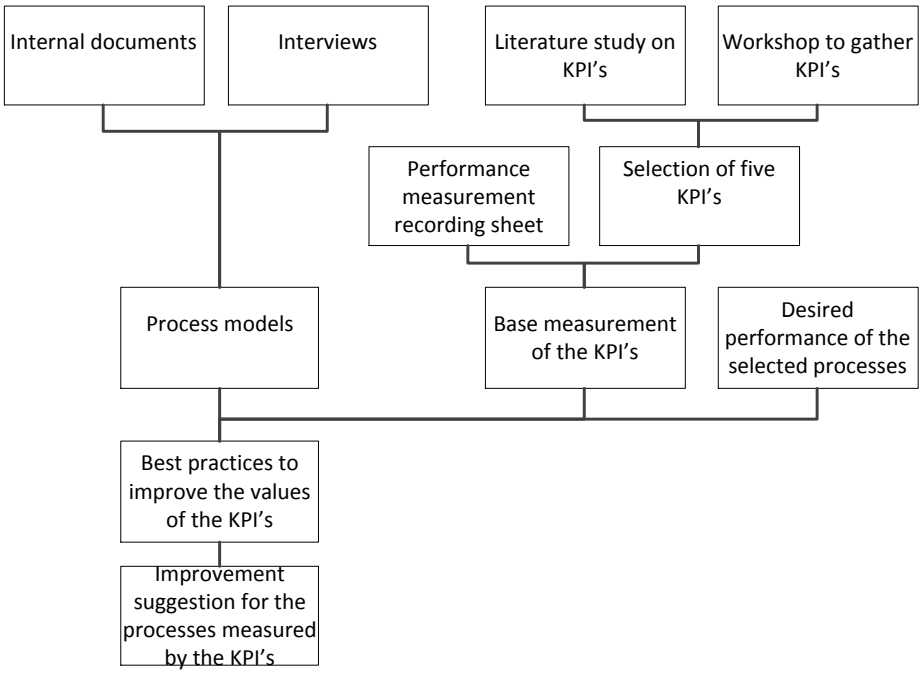


Figure 3 Research approach

1.4 Report structure

The report is structured as follows. Chapter two introduces the theoretical background, which will be used in the case study. More specifically, section 2.1 explains the business process modeling notation. This modeling language is used to model the processes in the first step of the BPRC. Section 2.2 gives insight into performance measurement, how to determine, classify and use them. Finally section 2.3 describes process improvement and the best practices used to improve some of the identified operational practices.

Chapter three explains the method in more detail. Section 3.1 explains the activities in step one of the BPRC, the identification of processes followed by section 3.2, which describes step 2, review, update, analyze the as-is processes. Finally section 3.3 explains the design to-be phase of the cycle.

The sections in chapter four correspond to the section in chapter three. This chapter explains the application of the method in the case study.

In chapter five the knowledge is brought into practice in the case study. Section 5.3 explains the operational processes at AIL. Subsequently section 5.4 describes the five selected KPI's followed by section 5.5, which gives process redesign suggestions for the selected processes. Section 5.6 is the conclusion of the case study

Chapter six concludes this report with a conclusion, discussion and limitations. Figure 4 shows the research structure.

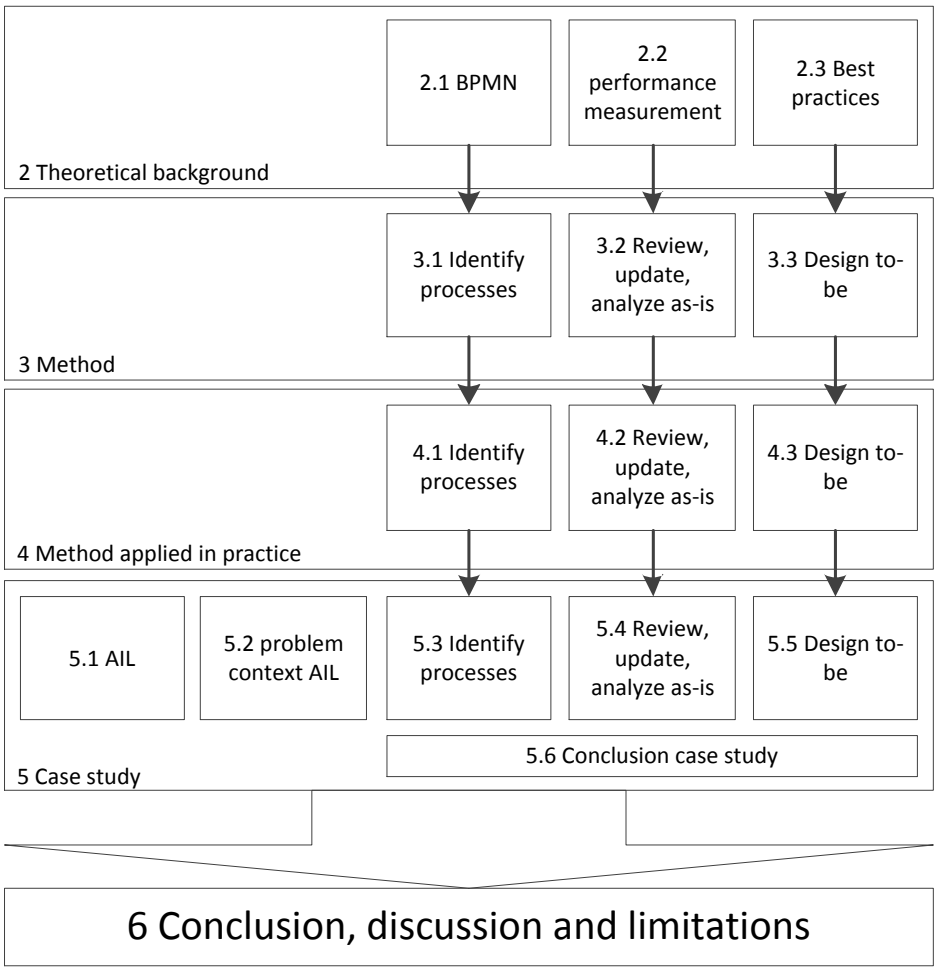


Figure 4 Report structure

2 Theoretical background

The theoretical background provides a literature insight into the topics covered in this thesis. Section 2.1 briefly introduces the business process modeling notation, which will be used to model the operational processes in the case study. Section 2.2 explains the topic of performance measurement and introduces a common way to define KPI's. Finally, section 2.3 covers the topic of best practices and lists the best practices found in literature.

2.1 Business process modeling notation

To get insight into and improve the operational processes, they have to be mapped. This section briefly introduces business process modeling and a modeling language to do so.

The definition of business process modeling appropriate for this thesis is: "an approach for visually depicting how businesses conduct their operations; defining and depicting entities, activities, enablers, events, states and the relationships between them" (Bandara, 2007). The resulting models can be used to analyze and improve the processes.

For process modeling, a modeling language is used. Different modeling languages exist, e.g. Business Process Modeling Notation (BPMN, (Object Management Group, 2010)), Event-driven Process Chain (EPC, (Keller, Nüttgens, & Scheer, 1992)), Unified Modeling Language (UML, (Object Management Group, 2011)) and IDEF0 (National Institute of Standards and Technology, 1993) are a few well known modeling languages. BPMN is a well supported language with the right modeling elements for the purpose of the models in this thesis and is therefore selected for this research.

BPMN was developed by the Business Process Management Initiative and is currently maintained by the Object Management Group (OMG). OMG defines the primary goal of BPMN as "to provide a notation that is readily understandable by all business users, from the business analysts that create the initial drafts of the processes, to the technical developers responsible for implementing the technology that will perform those processes, and finally, to the business people who will manage and monitor those processes. Thus, BPMN creates a standardized bridge for the gap between the business process design and process implementation." (Object Management Group, 2010). Additionally it enables the visualization of languages designed for the execution of business processes, in a business oriented notation.

The application of the models in this research is limited to visualization, communication, analysis and improvement purposes and above all, they should be easy to read by its users. For this reason, only core elements of the language will be used. This is supported by the research of Muehlen and Recker (2008) where they state that BPMN offers 50 modeling constructs, but less than 20% of its vocabulary is regularly used. Appendix B defines the used elements in this research.

Figure 5 shows an example of a BPMN model. First of all there are two actors in this process represented by two lanes, a data specialist and Albert Heijn (AH). The left circle is a start event and represents something that happens and it affects the flow of the process. In this case, it triggers the start of this process. It is followed by a rounded-corner rectangle, which represents an activity where work gets performed. Within a lane, events and activities are connected to each other by a solid line with a solid arrowhead. This is a sequence flow, which shows the order that activities will be performed in a process. From the first activity there is a dashed line with an open arrowhead, which shows the flow of messages between two separate process participants. To the second activity, a data object is connected that shows how data is required or produced by activities. Finally, the circle at the right is the end event where the process is terminated.

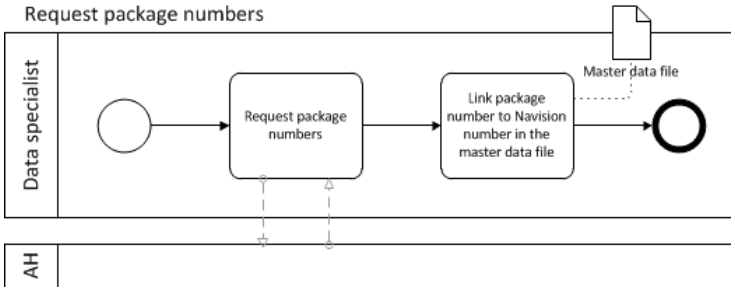


Figure 5 Example BPMN model

2.2 Performance measurement

To answer the first sub question of this study, insight into the field of performance measurement is required. This chapter introduces key performance indicators. More specifically it describes the history, importance and purpose of KPI's in section 2.2.1. Section 2.2.2 describes how to determine what to measure. For this purpose, section 2.2.3 introduces dimensions and frameworks for classifying KPI's. Finally, section 2.2.4 provides recommendations for defining KPI's. Both the dimensions and recommendations will be used for the determination and measurement of KPI's in the case study at AIL.

2.2.1 Key performance indicators

This section gives a general introduction into KPI's. The first part briefly describes KPI's and their history. Next, traditional performance measures (PM) are compared to non-traditional ones and also some limitations of the traditional PM's are described. The last part provides eight purposes for measuring performance and describes general benefits of performance measurement to a company.

Heckl and Moormann (2010) use different terms for the determination of process performance. According to them, performance indicators (PI) are used to determine process performance exactly and are based on the company's strategy. Performance measures determine how the performance indicator will be measured. Finally, performance figures represent the actual measurements. In this report, performance measure and performance indicator are used interchangeably.

History

"The performance measurement revolution started in the late 1970's with the dissatisfaction of traditional backward looking accounting systems." (Nudurupati, Bititci, Kumar, & Chan, 2011). Ghalayini and Noble (1996) state that there are two phases in literature. During the first phase from the late 1880's till the 1980's focus was on financial measures. The second phase started in the late 1980's due to a change in the world market. To maintain competitive, companies shifted their focus from low-cost to e.g. flexibility or quality. These changes required new performance measures, so non-financial measures became more important.

Limitations of traditional performance measures

As mentioned above, traditional performance systems focus on financial measures. They are narrow or uni-dimensional and a balanced set of measures is needed (Neely, Richards, Mills, Platts, & Bourne, 1997). Furthermore, they are output driven and historically focused (PricewaterhouseCoopers, 2007). Ghalayini and Noble (1996) provide a list of additional limitations to these traditional PM's of which some are described below:

- Lagging metrics: financial reports are usually closed monthly. Lagging metrics are therefore a result of past decisions or historical based.
- Corporate strategy: focus is on minimizing cost without or only partly a link to the corporate strategy.
- Relevant to practice: Performance cannot always be quantified in financial terms to keep it relevant to practice.
- Continuous improvement: setting standards or targets may be seen as setting a norm instead of a motivation for improvement.

Additionally Ghalayini and Noble (1996) give a comparison of traditional and non-traditional performance measures, which is shown in table 1.

Traditional performance measures clearly have their limitations and new PM's were desired. The non-traditional measures with both financial and non-financial measures overcome these limitations and offer more opportunities and better control.

Traditional performance measures	Non-traditional performance measures
Based on outdated traditional accounting system	Based on company strategy
Mainly financial measures	Mainly non-financial measures
Intended for middle and high managers	Intended for all employees
Lagging metrics (weekly or monthly)	On-time metrics (hourly or daily)
Difficult, confusing and misleading	Simple, accurate and easy to use
Lead to employee frustration	Lead to employee satisfaction
Neglected at the shopfloor	Frequently used at the shopfloor
Have a fixed format	Have no fixed format (depends on needs)
Do not vary between locations	Vary between locations
Do not change over time	Change over time as the need change
Intended mainly for monitoring performance	Intended to improve performance
Not applicable for JIT, TQM, CIM, FMS, RPR, etc.	Applicable
Hinders continuous improvement	Help in achieving continuous improvement

Table 1 A comparison between traditional and non-traditional performance measures (Ghalayini & Noble, 1996)

Purpose and benefits of performance measurement

Without any performance measure, it is hard to understand how a business performs, to detect problems and to improve performance. Therefore, PM's are important for operating a business and they should be selected carefully. "It has long been recognized that inadequately designed performance measures can result in dysfunctional behavior. Often because the method of calculating performance, the formula, encourages individuals to pursue inappropriate courses of action." (Neely et al., 1997).

Every stakeholder has his own reasons for measuring performance. Behn (2003) defines eight managerial purposes for measuring performance and adds characteristics for the measures. These characteristics describe what kind of measures or data can be used for the concerning purpose. The eight purposes are shown in table 2. The purposes and benefits described below show the diversity of reasons for measuring performance. It also shows that PM's are for all the stakeholders of a company. For example, investors are probably interested in the financial measures, while a shop-floor worker is more interested in real-time operational measures. PM's should thus be defined at different levels suited for the stakeholders involved. According to Gunasekaran, Patel, and Tirtiroglu (2001) performance metrics should be defined at the strategic, tactical and operational levels, each serving different stakeholders and purposes.

The purpose	The question that the PM can help to answer	Characteristic of the measures
Evaluate	How well is my company performing?	Outcomes, combined with inputs and the effects of exogenous factors
Control	How can I ensure that my subordinates are doing the right thing?	Inputs that can be regulated
Budget	On what programs, people, or projects should my company spend money	Efficiency measures
Motivate	How can I motivate employees to do the things necessary to improve performance?	Almost-real-time outputs compared with targets
Promote	How can I convince superiors, legislators, stakeholders etc. that my company is doing a good job?	Easily understood aspects of performance about which the stakeholders care
Celebrate	What accomplishments are worthy of the important organizational ritual of celebrating success?	Periodic and significant performance targets, when achieved, provides accomplishment
Learn	Why is what working or not?	Disaggregated data that can reveal deviances from the expected
Improve	What exactly should who do differently to improve performance?	Inside-the-black-box relationships that connect changes in operations to changes in outputs and outcomes

Table 2 Eight purposes and the accompanying characteristics (adapted from Behn (2003))

Next to the mentioned purposes, PM's also provide cultural, technical and other benefits to a company. Kaydos (1998) provides an overview of the benefits, such as:

- Improved control: with timely and meaningful feedback, people can detect deviations and respond in time.
- Clear responsibilities and objectives: everyone knows how he is performing, how he is supposed to perform and who is accountable.
- Strategic alignment of objectives: PM's can be used to communicate a company's strategy. This strategy should be broken down into lower level objectives. This assures that everyone is working according to the company's objectives.
- Understanding business processes: if you can measure performance and know what factors affects this performance, you understand the process.
- Knowing what a process can do, its capability: you know the limits of what is measured.
- Improved quality and productivity: the actual measurement already brings about improvement because of focused attention, communicating standards and the measurability of work. Next to this, PM's can be used to actively improve quality and productivity.
- More efficient allocation of resources: insight into performance makes resource allocation easier by establishing the relative importance of problems and opportunities.
- Better planning and forecasting: actual figures make it easier to plan and forecast.
- The freedom to delegate: when performance gets measured, it easier to delegate the work since you can check up on the work using the PM's.
- Defending your position: with PM's there is prove of the performance and the results.

- Changing a company's culture: common goals promote teamwork, clear objectives and responsibilities reduce conflicts, rational decision making instead of based on feelings, and open and honest communication.
- Seeing accomplishments and receiving recognition: people can take pride.
- Being evaluated objectively: this makes evaluation fair instead of when it is based on opinion.

Every stakeholder should decide for himself for what reason he wants to measure performance. There is not one right purpose as long as there is a purpose and it is clear what that purpose is. Implementing PI's will cost reasonable resources and effort but it is clear that it will provide benefits when done right.

2.2.2 Determining what to measure

This section introduces ways to classify and define performance measures. First the use of performance dimensions will be explained, followed by a brief overview of frequently used frameworks. Subsequently a set of recommendations is introduced, which will be used to make a performance measurement recording sheet.

Literature on determining performance measures is extensive and diverse. Authors use different approaches to determine and define PM's. One option is to select KPI's from libraries available on internet. The problem is that there is no generally accepted list of performance indicators. Additionally a set of requirements is needed for the selection and most likely the selected KPI's will not directly fit to the circumstances of the company. Defining own KPI's may therefore be a better option and also improves employee involvement and acceptance.

A common way found in literature for determining performance measures is by using performance dimensions or frameworks. Basically a framework is an arrangement of dimensions and will thus be used to create an overview of the dimensions. This section gives an overview of common dimensions used in literature. They will be used to guide the KPI gathering in the case study at the planning department of AIL.

Subsequently, some authors propose to use a set of recommendations to guide the determination of performance measures. These recommendations will be incorporated into a performance measurement recording sheet to make sure the defined KPI's satisfy these recommendations.

2.2.3 Performance measurement dimensions and frameworks

First, this section introduces common performance dimensions found in literature. Some authors use frameworks to search for and classify performance indicators. These kind of frameworks consist of similar performance dimensions as mentioned above, structured in a logical way. Popular frameworks and their dimensions found in literature will be introduced in this section. The dimensions are briefly explained in table 3.

Dimension	Explanation
Financial / Cost	Helps to answer: How do we look to our shareholders? Measures the economic impact. E.g. return on assets, net income, revenues per employee and development expenses.
Non-financial	Can include any of the below mentioned non-financial dimensions.
Customer	Helps to answer: How do our customers see us? Measures the ability to provide quality goods and services that meet customer expectations. E.g. results from customer surveys, customer profitability, loyalty and satisfaction.
Internal business process	Helps to answer: What must we excel at? Measures the internal business processes that create customer and shareholder satisfaction. E.g. Project management, total quality management and six sigma.
Innovation, technology, learning and growth	Helps to answer: How can we continue to improve and create value? Measures the organizational environment that fosters change, innovation, information sharing and growth. E.g. Staff morale, training, knowledge sharing, market share.
Productivity	Measures (employee) output, the uptime levels and how employees use their time. E.g. Sales-to-assets ratio and dollar revenue from new customers.
Quality	Measures the ability to meet and/or exceed the requirements and expectations of the customer. E.g. customer complaints, percent returns, defects per million opportunities.
Profitability	Measures the overall effectiveness of the management organization in generating profits. E.g. profit contribution by segment/customer, margin spreads.
Timeliness / Time (also leading, lagging)	Measures the point in time when management and employee tasks are completed. E.g. on-time delivery, percent of late orders. Also includes the leading and lagging dimension and more general, time.
(Process) efficiency	Measures how effectively the management organization incorporates quality control, Six Sigma and best practices to streamline operational processes. E.g. process uptime, capacity utilization. Also includes efficiency in general; degree to which the process produces the required output at minimum resource cost.
Cycle time	Measures the duration of time required by employees to complete tasks. E.g. processing time, time to service customer.
Resource (utilization)	Measures how effectively the management organization leverages existing business resources such as assets, bricks and mortar, investments. E.g.sales per total assets, sales per channel. Also includes resources in general.
Cost savings	Measures how successfully the management organization achieves economies of scale and scope of work with its people, staff and practices to control operational and overhead costs. E.g.cost per unit, inventory turns, cost of goods.
Safety	Measures the overall health of the organization and the working environment of its employees.
Output	General dimension that can include other dimensions like finacial, time, quality, products, and services.
Flexibility	Ability to respond to change. E.g. Volume-, delivery-, mix-, and new product flexibility.
External	Anything external to the company like, repeat buyers, market share, and competitive cost position.
Competitiveness	Intended as a lagging indicator to say something about how well the company does in comparison to competitors.
Strategy/vision	How well the company does according to its strategy. E.g. fulfilling the vision, market share, financial performance.
Delivery time	Externally focused and connected to customer satisfaction.
Waste	Waste of any kind, e.g. spoilage rate.
Input	Input to the company and proces. E.g. Skills and motivation of employees, customer requirements, plant and equipment, and capital.
Throughput	Input factors are utilized and combined. E.g. measures concerning development, production and delivery of products and services measures.
Result	General dimension that can include other dimensions like financial, customer statisfaction.
Operational, tactical, strategic	Concerned with the operational level where the KPI is implemented and short- or long term.

Table 3 Explanation of the dimensions

There is a diversity of ways to classify performance indicators. Bauer (2004) proposes to select appropriate measurement families in the development of KPI's: productivity, quality, profitability,

timeliness, process efficiency, cycle time, resource utilization, cost savings, growth, innovation and technology. These families can be used to direct the search for KPI's. Khadimi (2010) describes the categorization defined by the University of California, which consists of: efficiency, quality, timeliness, productivity and safety. Beamon (1999) and Lohman, Fortuin, and Wouters (2004) use resources, output and flexibility as PM types. Finally, Heckl and Moormann (2010) claim that the majority of authors have adopted a process oriented view, which uses the indicator groups: quality, time, cost and flexibility.

The next part of this section introduces frequently used frameworks with their dimensions. As stated earlier, performance measurement frameworks consist of performance dimensions. Since the definition of performance measure is not an exact science, these frameworks will not provide a business with specific performance measures but rather high-level PI groups (dimensions). It will help in the development of individualized measures.

The Balanced Scorecard is a popular framework, which was a response on the traditional financial PM systems (Kaplan & Norton, 1992). "The balanced scorecard is designed to assist management in aligning, communicating and tracking progress against ongoing business strategies, objectives and targets." (Bauer, 2004). It uses a balanced set of measures consisting of the following perspectives: financial, internal business, customer, and innovation and learning.

Keegan, Eiler, and Jones (1989) introduced a Performance Measurement Matrix, which also uses a categorization of performance measures: internal, external, non-cost and cost.

Fitzgerald, Johnston, and Brignall (1991) introduced a framework, which "is based on the premise that there are two basic types of performance measure in any organization, those that relate to results (competitiveness, financial performance), and those that focus on the determinants of the results (quality, flexibility, resource utilization and innovation)" (Neely, et al., 2000). Results will be the lagging indicators and the determinants will be the leading indicators.

The Performance Pyramid by Lynch and Cross (1991), uses a hierarchical view of performance. The top two layers represent strategic performance whereas the bottom layer represents the process performance. The PI's in the third layer impact both the strategic and the process performance level.

The Institute of Chartered Accountants (1993) developed a framework based on business planning and monitoring operations (leading and lagging indicators) and combined these with financial and non-financial measures. These are then mapped onto two tree diagrams.

Brown (1996) created a framework with a strong process perspective and suggests measures for: input, process/throughput, output and result.

The Business Excellence Model of the European Foundation for Quality Management (2011) consists of two subsets of performance factors: enablers (leading) and results (lagging).

Instead of using dimensions to classify PI's Khadimi (2010) and Gunasekaran et al. (2001) suggest to look from different perspectives. At the Operational level, performance metrics are for the short-term whereas the tactical and strategic measures are about the long term performance. Yet another way to classify PM's is whether they are leading or lagging. Leading indicators are aimed at future performance while lagging indicators are output driven and say something about past performance.

Concluded can be that there is no consensus on what categorization of PI's is best. Most approaches overlap in some way. Others use the same naming but differ in their explanation. The statement "other authors… have all pointed out that generic terms quality, time, cost and flexibility encompass a variety of different dimensions." (Neely, Gregory, & Platts, 1995) makes clear that there is no agreement on a specific set of performance dimensions. Table 4 gives an overview of the used articles, dimensions and frameworks. Quality, time, resource (and financial/cost in general), and flexibility are the most mentioned dimensions in the used literature. It is up to the people involved in designing the performance measures what approach to use. Based on e.g. the company, discipline, organizational level, interest of the stakeholders, a decision should be made on what PM dimensions to use for its measures. For this research, the most frequent stated dimensions, cost/resource, quality, time and flexibility will be used to guide the KPI determination.

	Dimension / Metric classification																								
Author	Financial / Cost	Non-financial	Customer	Internal business process	Innovation, technology, learning and growth	Productivity	Quality	Profitability	Timeliness / Time (also leading, lagging)	(Process) efficiency	Cycle time	Resource (utilization)	Cost savings	Safety	Output	Flexibility	External	Competitiveness	Strategy/vision	Delivery time	Waste	Input	Throughput	Result	Operational, tactical, strategic
Bauer (2004)		V			V	V	V	V	V	V	V	V	V												
Khadimi (2010)		V				V	V		V	V				V											
Beamon (1999)		V										V			V	V									
Lohman et al. (2004)		V										V			V	V									
Heckl & Moormann (2010)	V	V					V		V							V									
Gunasekaran et al. (2001)		V																							V
Framework																									
Balanced scorecard	V	V	V	V	V																				
Performance measurement matrix	V	V		V													V								
Results and determinants	V	V			V		V		V			V				V		V							
Performance pyramid	V	V	V			V	V				V					V	V		V	V	V				
ICAS model / DuPont	V	V							V																
Brown's framework	V	V													V							V	V	V	
Business excellence model	V	V	V	V	V				V			V					V		V					V	

Table 4 Performance metrics classification comparison

2.2.4 Recommendations

Recommendations can be found in literature that help in defining good performance measures. This section introduces such recommendations.

Commonly found in literature are the SMART criteria to test the quality of a KPI. Following this, a performance indicator should be Specific, Measurable, Attainable, Realistic and Timely (variations exist). More comprehensive but less practical to use are the recommendations for KPI's. As stated in the introduction, some authors provide recommendations that help to define good KPI's. Neely et al. (1997), Neely et al. (2000) and Folan and Browne (2005) provide recommendations or desirable characteristics of a performance measurement framework. This should be used as a guide, rather than as rules. Table 5 gives an overview of the recommendations. Again, these are useful but do not provide specific direction on what to measure. Neely et al. (1997) use their recommendations to compose a performance measure record sheet, which will be used in this research.

Any KPI should be clearly defined and registered in a performance measure record sheet. Neely et al. (1997) show in their article how every recommendation is covered by the subjects on the recording sheet. Using this sheet makes sure the KPI is well thought-out and well defined. Their PM record sheet consist of: title, purpose, relates to, target, formula, frequency of measurement, frequency of review, who measures, source of data, who owns the measure, what do they do, who acts on the data, what do they do, notes and comments. To make it more detailed, this recording sheet is complemented with items from the recording sheet from smartkpis.com: department, definition, formula type, unit type, timescale, and trend. The resulting measurement sheet can be found in appendix H.

The actual measurement of the KPI's is often done by performance measurement systems but can also be done manually or data can be retrieved from available data.

	Recommendation / characteristic	Neely, A. 1997	Neely, A. 2000	Folan, P 2005
1	Performance measures should be derived from strategy	V	V	V
2	Performance measures should be simple to understand	V	V	V
3	Performance measures should provide timely and accurate feedback	V	V	V
4	Performance measures should be based on quantities that can be influenced, or controlled, by the user alone or in co-operation with others	V	V	
5	Performance measures should reflect the "business process" - i.e. Both the supplier and customer should be involved in the definition of the measures	V	V	
6	Performance measures should relate to specific goals (targets)	V		V
7	Performance measures should be relevant	V		
8	Performance measures should be part of a closed management loop	V		
9	Performance measures should be clearly defined	V		V
10	Performance measures should have visual impact	V		V
11	Performance measures should focus on improvement	V	V	V
12	Performance measures should be consistent (in that they maintain their significance as time goes by)	V		
13	Performance measures should provide fast feedback	V		V
14	Performance measures should have an explicit purpose	V	V	
15	Performance measures should be based on an explicitly defined formula and source of data	V	V	V
16	Performance measures should employ ratios rather than absolute numbers	V	V	
17	Performance measures should use data which are automatically collected as part of a process whenever possible	V		V
18	Performance measures should be reported in a simple consistent format	V		
19	Performance measures should be based on trends rather than snapshots	V		
20	Performance measures should provide information	V		
21	Performance measures should be precise – be exact about what is being measured	V		V
22	Performance measures should be objective – not based on opinion	V	V	
23	The performance measures that are selected should take account of the organization		V	
24	The process should be easily revisable - measures should change as circumstances change		V	
25	Performance measures should enable/facilitate benchmarking		V	V
26	Non-financial measures should be adopted		V	V
27	Performance measures should be based upon multi-criteria (critical activities)			V
28	Criteria should evaluate group not individual work			V
29	Data should be collected, where possible, by those whose performance is being evaluated			V
30	Data should be available for constant review			V
31	Should convey information through as few and as simple a set of measures as possible			V
32	PM systems should reveal how effectively customers' needs and expectations are satisfied			V
33	Focus upon measures that customer can see			V
34	Provide measures that allow all members of the organization to understand how they affect the business			V
35	Feedback from PM systems should report at numerous levels of the organization			V
36	Should enable managers to view performance in several areas simultaneously			V
37	PM's should be implemented in such a way that it does not induce fear, politics and subversion			V
38	PM's should be designed so that they facilitate auditing			V
39	PM's should be viewed as a co-ordination effort to understand current metrics in detail, to identify shortcomings and to include ongoing initiatives that affect PM			V

Table 5 Recommendations with regard to the design of performance measures

2.3 Best practices

Many techniques are available for BPR. The ones used in this research are process modeling and the application of best practices. Process modeling is already introduced so this section explains the best practices in BPR.

“An ideal best practice prescribes the best way to treat a particular problem that can be replicated in any situation or setting.” (Reijers & Mansar, 2005). In their article they formulate 29 best practices, which they retrieved from literature or are based on own experience. These best practices are especially aimed at efforts where existing business processes are taken as a basis for its redesign. Best practices focus on the mechanics of the process and do not cover how the behavior of people working within the process can be influenced. Table 6 lists these best practices.

Reijers and Mansar (2005) use the devil’s quadrangle of Brand and van der Kolk (1995) to evaluate the effect of each best practice. The devil’s quadrangle distinguishes four dimensions: time, cost, quality, and flexibility and presents them graphically. The same as with the KPI dimensions, these dimensions are generic and should be adapted to the context. Figure 6 shows an example of the devil’s quadrangle. The grey part represents the neutral effect on the four dimensions. The effect of an improvement is shown by a polygon. A positive effect is shown by extending the polygon beyond the neutral square (vice versa for a negative effect).The goal of BPR in this research is to improve the concerned KPI values but to prevent (too many) negative side effects on the other dimensions, also the devil’s quadrangle will be used for evaluation. Other aspects of BPR efforts like, change management or organizational change are, although important, out of scope of this research and will not be discussed.

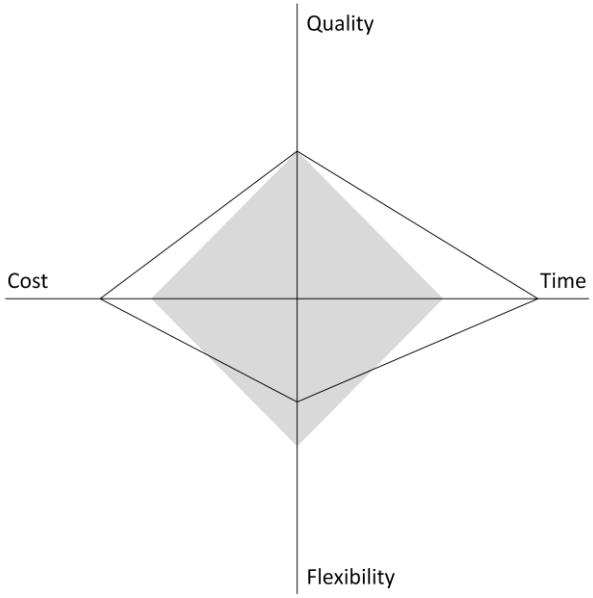


Figure 6 An example of the devil’s quadrangle

Best practices
1 Control relocation: 'move controls towards the customer'
Different checks and reconciliation operations that are part of a business process may be moved towards the customer.
Pros: reduced number of errors and improved customer satisfaction.
Cons: higher probability of fraud.
2 Contact reduction: 'reduce the number of contacts with customers and third parties'
The exchange of information with a customer or third party can be time-consuming (non EDI) and may introduce human error.
Pros: reduced amount of time and improved quality.
Cons: possible loss of essential information (quality) and combining contacts may result in information overload.
3 Integration: 'consider the integration with a business process of the customer or a supplier'
This best practices can be seen as exploiting the supply-chain concept known in production.
Pros: more efficient execution, both from a time and cost perspective.
Cons: mutual independence grows and therefore flexibility may decrease.
4 Order types: 'determine whether tasks are related to the same type of order and, if necessary distinguish new business processes'
Business processes that are not specific for the business process they are part of may result in a less effective management of this 'subflow' and a lower efficiency.
Pros: faster processing time, less cost and may yield efficiency gains.
Cons: possibly more coordination problems (quality) and less possibilities for rearranging the business processes (flexibility).
5 Task elimination: 'elimintate unnecessary tasks from a business process'
A common way of regarding a task as unnecessary is when it adds no value from a customer's point of view.
Pros: increase processing speed and reduce handling cost.
Cons: quality detoriation.
6 Order-based work: 'consider removing batch-processing and periodic activities from a business process'
Pros: may speed up handling of individual orders.
Cons: less efficiencies of scale and possible increases of cost because of permanent information system availability.
7 Triage: 'consider the division of a general task into two or more alternative tasks' or 'consider the integration of two or more alternative tasks into one general taks'
Alternative tasks may result in tasks that are better aligned with the capabilities of the resources and improves resouce utilization.
Pros: improved capability alignment, improved quality of the process, increased utilization with cost and time advantages.
Cons: too much specialization leads to less flexibility, less efficiency, and cause monotonous work which decreases quality of work.
8 Task composition: 'combine small tasks into composite tasks and divide large tasks into workable smaller tasks'
This best practices is related to the triage best practice. Combining should result in reduction of setup times and quality may increase. Making the task to large may result in smaller run-time flexibility and lower quality. Dividing tasks leads to opposite results.
9 Resequencing: 'move tasks to more appropriate places'
Sometimes it is better to postpone a task if it is not required for immediately following tasks, so that perhaps its execution may prove to become superfluous.
Pros: save cost and possibly reduces setup times.
10 Knock-out: 'order knock-outs in a decreasing order of effort and in an increasing order of termination probability'
If there is freedom in choosing the order in which the various conditions are checked, the condition that has the most favorable ratio of expected knock-out probability versus the expected effort to check the condition should be pursued.
Pros: cost reduction.

11 Parallelism: 'consider whether tasks may be executed in parallel'
Pros: reduction of throughput time.
Cons: cost of process execution may increase, management becomes more complex, this can lead to errors (quality) and restrictions in run-time adaptations (flexibility).
12 Exception: 'design business processes for typical orders and isolate exceptional orders from normal flow'
Exceptions disturb normal operations.
Pros: handling of normal orders more efficient and possibly improves performance.
Cons: business process becomes more complex, possibly decreasing flexibility.
13 Order assignment: 'let workers perform as many steps as possible for single orders'
Pros: less setup time and possibly increased quality of service.
Cons: decrease in resource allocation flexibility and increase in queue time when the resource is unavailable.
14 Flexible assignment: 'assign resources in such a way that maximal flexibility is preserved for the near future'
E.g. Assign the most specialized resource to a task so the more general resource can execute another task.
Pros: reduction in overall queue time and specialized resource does most of the work which may lead to increased quality.
Cons: unbalanced workload.
15 Centralization: 'treat geographically dispersed resources as if they are centralized'
Pros: flexible resources which can result in better utilization and better throughput time.
Cons: technology investment may be costly.
16 Split responsibilities: 'avoid assignment of task responsibilities to people from different functional units'
Shared responsibilities may lead to neglect and conflict.
Pros: better quality of task execution and possible higher responsiveness may be developed so that customers are served quicker.
Cons: reduced number of resources available may have a negative effect on its thourhgput time.
17 Customer teams: 'consider assigning teams out of different departmental workers that will take care of the complete handling of specific sorts of orders'
Pros: less setup time, possibly increased quality of service, and improved attractiveness of work and better understanding (quality).
Cons: decrease in resource allocation flexibility and increase in queue time when the resource is unavailable.
18 Numerical involvement: 'minimize the number of departments, groups and persons involved in a business process'
Pros: less coordination problems and less split responsibilities (see the split responsibilities best practice).
Cons: smaler numbers of specialized units may prohibit the build of expertise (quality) and routine (cost).
19 Case manager: 'appoint one person as responsible for the handling of each type of order, the case manager'
Emphasis is on management of the process and not on its execution.
Pros: business process becomes more transparent from the viewpoint of a customer (customer satisfaction) and it may also have a positive effect on the internal quality of the process.
Cons: capacity must be devoted to this job.
20 Extra resources: 'if capacity is not sufficient, consider increasing the number of resources'
Pros: increased capacity (time) and possibly more flexible assignment.
Cons: increased cost.
21 Specialist-generalist: 'consider to make resources more specialized or more generalist'
Specialists build up routine and may have more knowledge than a generalist. As a result he or she works quicker and delivers higher quality. On the other hand, generalists add more flexibility and can lead to a better utilization of resources.
22 Empower: 'give workers most of the decisionmaking authority and reduce middle management'
In traditional business processes, substantial time may be spent on authorizing work that has been done by others.
Pros: may result in smoother operations with lower throughput times. Reduction of middle management also reduces cost.
Cons: possible reduction in decision quality, errors may be unnoticed which can lead to rework and thus increasing time and cost.

23 Control addition: 'check the completeness and correctness of incoming materials and check the output before it is send to customers'
Pros: higher quality of process execution and this less rework.
Cons: requires time and uses resources.
24 Buffering: 'instead of requesting information from an external source, buffer it by subscribing to updates'
Obtaining information from other parties may be time-consuming. Having this information directly available reduces throughput times.
Pros: reduced throughput times.
Cons: possible subscription fee for information updates may be costly.
25 Task automation: 'consider automating tasks'
Pros: faster task execution with less cost and possible better result.
Cons: development of such a system may be costly and process execution is less flexible.
26 Integral technology: 'try to elevate physical constraints in a business process by applying new technology'
New technology can offer all kinds of effects and can change the way of doing business.
27 Trusted party: 'instead of determining information oneself, use results of a trusted party'
Some decisions or assessments that are made within a business process are not specific for the business process they are part of. Other parties may have determined the same information already.
Pros: reduces cost and may cut back throughput time.
Cons: process quality dependent upon the quality of other party's work, and increased coordination.
28 Outsourcing: 'consider outsourcing a business process in whole or parts of it'
Another party may be more efficient in performing the same work.
Pros: less cost.
Cons: possibly decreased quality, and needs more coordination.
29 Interfacing: 'consider a standardized interface with customers and partners'
Pros: less errors (quality), faster processing (time) and less rework (cost).

Table 6 Best practices (Reijers & Mansar, 2005)

3 Method

This chapter elaborates on the first three steps of the business process reengineering cycle. Insight from literature is used to develop a structured approach. Section 3.1 is about identifying processes, followed by section 3.2 describing step two from the BPRC. Finally, section 3.3 goes into designing the to-be processes.

3.1 Identify processes

Identifying processes consists of three steps: 1. Identify processes, 2. Model the processes, 3. Validate the process models.

For the identification of processes, existing documentation should be analyzed if available. To complement this data and gather up-to-date information on the processes, interviews should be conducted with people involved in the processes.

With the gathered information, the processes can then be modeled using BPMN. The complexity of the models and modeling elements used, should be based on the purpose and potential use of the models.

The process models should then be validated by people involved in the processes and when necessary they should be corrected.

3.2 Review, update, analyze as-is

To analyze the as-is processes, their performance should be measured using key performance indicators.

Section 2.2.3 introduced dimensions and performance measurement frameworks. “Such frameworks are undoubtedly valuable, their adoption is often constrained by the fact that they are simply frameworks. They suggest some areas in which measures of performance might be useful, but provide little guidance on how the appropriate measures can be identified, introduced and ultimately used to manage the business…to be of practical value, the process of populating the framework has to be understood.” (Neely, et al., 2000). Often it starts by stating the business goals or strategy and then somehow derive performance measures. Little guidance on actually deciding what to measure is provided by literature. Some practical methods that are introduced are e.g. cause-effect analysis and interviews (Kaydos, 1998) or workshops (Kaplan & Norton, 1993).

For this research, workshops will be used to gather KPI’s. People involved in the processes participate in a brainstorm session. This encourages participation, increases acceptance amongst employees and after all, it is their performance that will be measured. Because performance dimensions are commonly used in performance measurement practice, one workshop should have a dimension orientation. This means that the starting point of the brainstorm is a performance dimension and from there, participants think of KPI’s relating to their work or processes.

Because the focus of this research is on process redesign, also a process oriented approach is examined. Kueng (2000) describes a process performance measurement system but again, provides little guidance on populating the system. Again a workshop should be used, this time with the process orientation. This means that the starting point of the brainstorm is a process and from there, participants think of KPI's.

At both workshops, participants are asked to make their own list of favorites. These are put together and from this list, a selection for further inspection should be made and recorded using a performance measurement recording sheet.

Finally, the performance of the selected KPI's should be measured and serve as base measurements.

3.3 Design to-be

Processes that have the biggest impact on the selected KPI's should to be selected. For every process, all 29 best practices should be considered. This results in redesign suggestions and potential performance improvement.

To evaluate the result of the suggestions, the expected impact on the KPI value is evaluated. Additionally, the devil's quadrangle is used to evaluate the general effect.

4 Method applied in case study

This chapter sets out in detail how the suggested method is used in the case study. Section 4.1 explains the data gathering process for the modeling of the operational processes. Section 4.2 describes the workshops held at AIL and the selection of the five KPI's. Finally, section 4.3 describes the redesign phase of this study.

4.1 Identify processes

This section explains the modeling phase of the operational processes. The goal is to map the actual (execution of) processes. The purpose of the models is to create a clear picture and show the flow of the processes and show responsibilities of the actors. They will mainly be used for communication purposes and should thus be readable to all the people to whom it concerns. Additionally they will be used for analysis and process improvement. Within scope are all the processes within AIL that contribute to the core business of AIL, which is to deliver goods to the OPCO's. Interacting stakeholders outside AIL will mostly be included in the models as empty lanes. When their internal activities are relevant in a modeling sense, they are included in the model. The remainder of this section describes the collection of data.

Two documented sources of data are available at AIL for input of the modeling phase:

1. Original manuals that were created at the start of AIL. These are text documents, which state objectives, actors, time of occurrence and the activities of the processes. They are high-level, only describing processes of main activities and leaving out sub- and support processes, and describe process steps in detail. Although they describe the processes well, they do not give a clear view of the process flow.
2. A process description document, which is in progress, created by the team leader planning and an inbound logistic assistant. This is a text document describing all but only the planning processes. It is low level, it describes the actual operational processes, and describes process steps in detail. It does not state the objectives or actors explicitly but the descriptions are clear.

The original manuals are mainly used to gain insight in the processes and serve as input for the interviews. Some manuals date from the beginning of AIL and are outdated. Others do not fit with the actual execution of the processes. The more recent process descriptions from the team leader and ILA are used as a base description for the models. Their level of detail matches better with the intended level for the process models. Both these sources serve as input for the interviews. The interviews are used to complement the process descriptions and to find out the actual execution and missing activities and processes.

Interviews are conducted with the majority of the employees at AIL. To assure that all known processes are covered, employees involved in those processes are selected for the interviews. Every position and role within AIL is covered several times to ensure that the processes are described well and with enough detail. Appendix C shows the selection of interviewees. The interviews are semi-structured to maximize

the output. First the interviewee is asked to list the processes in which they are involved. Next they are asked to explain those processes in detail, covering at least a fixed set of items. The interview protocol can be found in appendix D.

These three sources are combined and result in the process models. The modeling will be low level, visualizing the actual course of all the operational processes, and detailed.

All the models are then validated. Several employees are asked to check and comment on the models, which are then corrected (appendix E shows the validation overview). Every model is checked by at least two concerned employees, except for those processes with only one employee of AIL involved.

4.2 Review, update, analyze as-is

This section describes the determination of KPI's. In agreement with AIL, the goal is set to define five KPI's for the planning department of AIL. Initially the purpose is to get insight into the performance of the department. According to table 2 this would be for learning or evaluation purposes. In the longer term, the defined KPI's serve all purposes of table 2 but evaluation, control, learning and improvement, are the most important reasons for having them. The exact purpose of each KPI differs per KPI.

In agreement with AIL, it is decided to involve most of the planning staff in the determination of KPI's. This encourages participation, increases acceptance amongst employees and after all, it is their performance that will be measured. The planning group will be divided into two groups and also the team leader of planning and the director are involved (employees involved are listed in appendix C). Two brainstorm sessions (sort of workshop proposed by (Kaplan & Norton, 1993)) are organized with both a different orientation to maximize output. The goal of these sessions is to generate a list of performance measures applicable to the planning department.

The first session had a process orientation and involved five participants. The session starts with a brief introduction on KPI's and by explaining the course and rules of the session. Next the goal of AIL is stated and the specific goal of the planning department is formulated by the participants. Subsequently this is translated into what is important for the department followed by the operational processes that are employed within planning to reach the goal. Per process, the sub-processes and related subjects are listed. Collectively a list is generated of what they want to know about these processes, what is critical and what can go wrong, in KPI format. From these resulting lists, every participant makes his top list.

The second session had a dimension orientation and involved five participants. The start of this session is the same as the previous one. Instead of using processes as a starting point to generate KPIs, dimensions from the literature review are used. The four dimensions, which are often stated in literature and appear frequently in table 4 are used: quality, time, flexibility and cost. Because these terms are generic, several examples applicable to the department are given to guide the participants. Per dimension, KPI's for the

entire planning department are generated collectively. Again, every participant makes his top list from the resulting KPI's.

The two lists of KPI's are then merged and sorted on frequency the KPI is listed by the participants. Together with the director and team leader of planning, a top five will be composed. These indicators will be defined according to the performance measurement recording sheet. This ensures that the defined KPI's comply with the recommendations given by Neely et al. (1997) and thus are defined precisely. This implicitly means the KPI's are specified SMART. Appendix H shows the recording sheets for the five selected KPI's.

The actual KPI measurements will be retrieved from currently existing overviews or will be measured manually. The results will be presented on a dashboard using Excel.

4.3 Design to-be

This section explains the approach for redesigning the operational processes at the planning department of AIL. As described in section 3.3 the processes with the biggest impact on the five KPI's are selected. All 29 best practices are considered for each process. This results in redesign suggestion for the concerned processes.

The impact of the proposed changes will be evaluated using the expected impact on the corresponding KPI and the devil's quadrangle.

5 Case study

This chapter explains the case study. Section 5.1 introduces the company where the case study is conducted followed by the problem context in section 5.2. Section 5.3 is about the operational processes at AIL followed by section 5.4 describing the five selected KPI's. In section 5.5 best practices are applied to improve the performance of certain processes.

5.1 Ahold Inbound Logistics

This section introduces the company where the case study is conducted.

Ahold Inbound Logistics (AIL) is a full subsidiary of Royal Ahold N.V. Figure 7 shows AIL's position within the holding. Ahold operates on the European market with the brands: Albert Heijn, Etos, Gall & Gall, Albert, Hypernova, ICA and Pingo Doce. On the US market they have the following brands: Stop & Shop, Giant, Peapod and Martin's. These are the operating companies (OPCO).

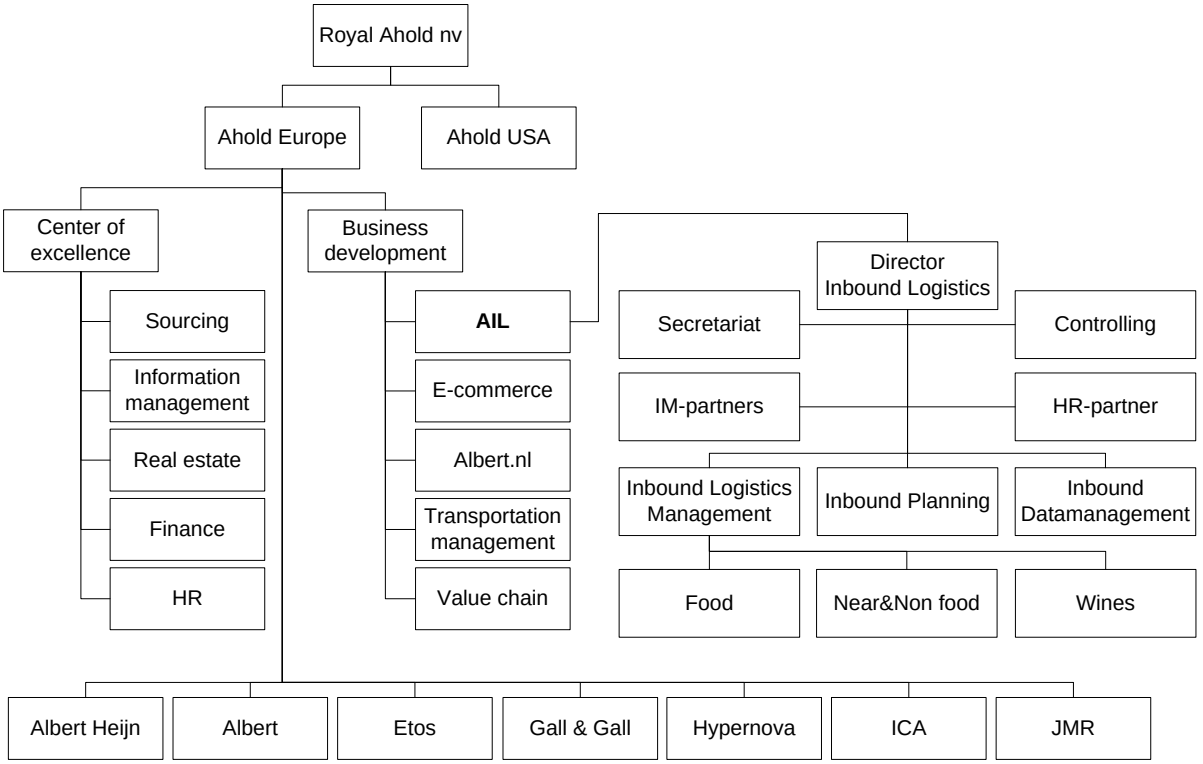


Figure 7 Structure of Ahold N.V. and AIL

AIL functions as an internal supplier to Albert Heijn, Etos, Gall & Gall and Ahold Czech Republic and is the link between the supplier and the distribution centers (DC) of the OPCO's. It operates from its own buffer DC in Tiel, which is owned by Simon & Loos. Upstream it orders preferably full truck loads (FTL) at the supplier and arranges transport to the buffer DC. Planners at AIL will arrange transport from the buffer DC to the DC's of the OPCO's, which are combined orders, preferably FTL's.

AIL started in 2006 with the objective: to manage the international inbound supply chain infrastructure and process that enables Ahold Europe OPCO's to reduce the total cost of ownership (TCO) of purchased goods. This process is visualized in figure 8. Normally a purchasing agent buys goods at a supplier, which will ship the goods to the DC's for a certain price. Another option is to let AIL ship the goods, which may be a cheaper option. Another scenario is about order size. Space in DC's of the OPCO's is limited, which restricts the order size. Especially for orders overseas, ordering in bigger sizes is often cheaper. AIL can take this order and store it in its DC. Basically, AIL orders at a supplier and arranges a TSP to take care of the transport to the buffer DC of AIL. When replenishment orders goods at AIL, AIL arranges transport to the OPCO's DC using the Ahold transport network.

Basically, reasons to have AIL are:

- Support negotiation process buyers
- Meet competitors advantages and strategies (competitors also have own inbound logistic departments acting on a global level)
- Change or balance the power in the supply chain
- To implement and simplify replenishment systems
- To overcome substantial infrastructural problems at DCs
- Financials

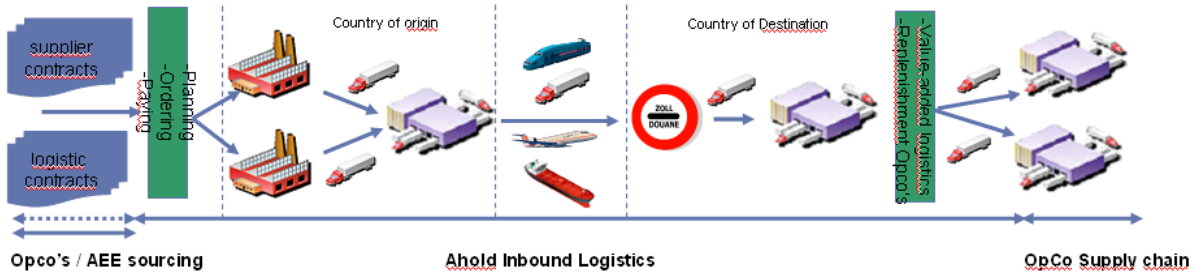


Figure 8 Supply chain of AIL (from internal PowerPoint presentation of AIL)

AIL is a department with about 21 employees including planners, logistic managers and data specialists and is structured as in figure 7. It implemented the ERP system Microsoft Dynamics (Navision) on a HP-infrastructure with an EDI infrastructure via Ahold EDI Team to facilitate its core processes.

5.2 Problem context at AIL

This section explains the problem context at AIL.

Since the start in 2006, the department experienced growth in multiple areas. From a turnover of 30 million euro in 2007 it grew to 300 million euro in 2009. This was accompanied by an increased amount of articles, vendors and increased complexity of the operation and its processes. In the process of growth, the structured management of work procedures, documentation, processes and data integrity received less attention. This led to different kind of performance issues, which makes the performance

of AIL non optimal. These issues and the corresponding causes are mapped in the cause and effect diagram in figure 9. This diagram is based on semi-structured interviews with employees of AIL. There are many bigger and smaller causes for the non-optimal performance. The main issues are printed bold in figure 9 and are listed below.

1. The current systems and forms contain erroneous and incomplete data. This leads to rework and delay or problems later in the process.
2. Several factors lead to delay in the process. Eventually this can lead to problems at the OPCO's.
3. AIL is the only department within Ahold that runs the ERP system Navision. Additionally this system is highly customized and some parts are outdated.
4. AIL lacks performance targets and indicators on certain operational dimensions.

It is clear that AIL is a growing and continuously changing department. In this process one could easily lose track of all the changes in procedures, processes and the relations between them. Many factors influence the flow of the processes and in the end the performance of AIL as a department. To get a clear picture of AIL and make it better manageable, the current operations of the department should be mapped. This is the first step in making the process measurable. The gained process models can be used to formulate performance indicators. These are required to measure current performance and set targets for improvement. This can be used to optimize the operations and support future growth.

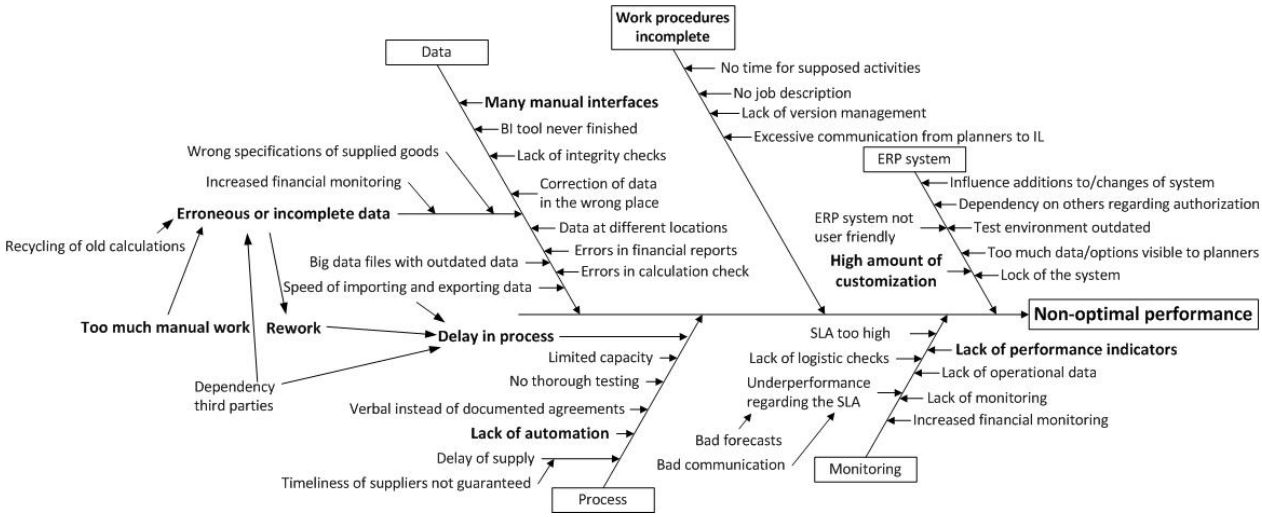


Figure 9 Cause and effect diagram

This research is beneficial for AIL because of the following reasons:

1. There is only little up-to-date documentation on the operational processes currently available at AIL. A first step in activities such as, training of new employees, communication to different stakeholders, performance measurement and process improvement is to map the business processes. One of the deliverables of this project is a set of business process models.
2. To get insight into the performance of the operational processes and eventually improve it, performance measures are formulated. This makes the processes measurable and controllable. Current performance can be measured and targets can be set for improvement.

3. The problem analysis shows there is room for improvement. Based on the previous results, a few selected processes will be analyzed and advice on improvement will be formulated.

In general, the result of this case study gives AIL a comprehensive overview of current practices and a manual to further implement performance measures and improve their processes.

5.3 Identify processes

37 Operational processes were identified at AIL and are modeled using BPMN. Additionally a high-level model describing AIL's activities and a visual representation of AIL are made to provide an overall overview. Appendix F contains all the process models. This section briefly describes the normal course of the processes of AIL. AIL uses four categories for the assortment: food, near-food, non-food and wine. Processes may differ between these categories. Variations and exceptions will not be discussed. The processes can be divided into the following groups (figure 10): product request, inbound, outbound, and support.

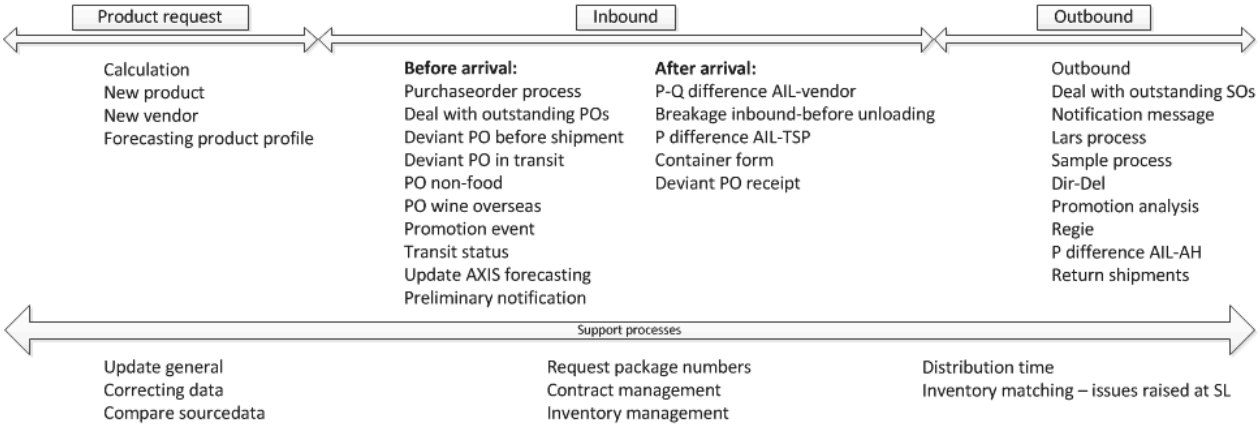


Figure 10 Processes of AIL divided into groups

In general, AIL's operations can be described by its objective: *Support AES (Ahold European sourcing) with different trade lanes with international sourced goods to provide the Ahold brands maximum product availability against the lowest costs in a sustainable way.* The following sections describe the processes that serve this objective. Process names are printed italic.

Product request

AIL operates on request of Ahold European sourcing. It starts when category management, responsible for the assortment of the Ahold brands (or OPCO's), decides to add a product to the assortment. They ask AES to provide this product against the lowest price. AES will then select suppliers and request quotations for delivering the product to the OPCO's DC's. They can also ask AIL to deliver the product to their DC and request a quotation from AIL. This is where AIL gets involved. An inbound logistic manager or assistant makes a *calculation* and provides AIL's delivery price. AES will decide whether they award the contract to AIL. Basically, a calculation contains the contract, product and vendor data, logistic

parameters and prices and other financial data. In the process of making a calculation, the *new product* and *new vendor* are build up in the system with the involvement of a data specialist. Additionally a *forecasting product profile* will be added, which is required for a planner to forecast and order the product.

Inbound

This is the inbound process to AIL, which basically is, ordering goods at a supplier and arrange transport to the buffer DC of AIL. The inbound logistic manager/assistant (ILM/A) has already determined the stock level that should be available at Simon Loos (SL, the buffer DC or LSP can be used interchangeably) and provided a forecast profile. (*purchase order process*) Based on this, a planner runs the forecasting tool to generate an order suggestion. After checking and or adjusting the order, a purchase order (PO) is created, which will be sent to the supplier and TSP. These two parties will arrange the pick-up. The *PO for wine overseas* is created using a different tool and in cooperation with a consultant. The *PO for non-food* process is different from food and near-food e.g. it does not use a forecasting tool and requires involvement of the ILA. The *promotion event* process is another PO process. The category manager decides on promotions and informs the ILA. He puts the promotion into the promotion sheet after which the planner deals with the ordering of the goods.

When transit takes more than three days, the *transit status* needs to be updated in Navision. All kind of deviations occur between the PO and the actual shipment after the PO has been created, e.g. on quality, quantity or delivery date. This can be detected *before shipment*, *in transit* or on *receipt*. The planner has to take appropriate action e.g. change the PO. During transport, breakage can occur. In the *breakage inbound before unloading* process, the planner deals with it and allocates the cost to the right party.

Before an order arrives at SL, AIL will send a *preliminary notification* to notify SL what TSP's they can expect. TSP's not listed in the notification cannot unload. The data on TSP arrivals could differ between AIL and SL so this gets checked and updated. It can occur that an expected TSP does not show up. In this case, the planner has to *deal with the outstanding PO* and contacts the TSP.

On arrival of non-food shipments, a *container form* has to be filled in. This form contains data on product and pallet stacking and should match to the predetermined stacking. In case of deviation SL should adjust the stacking when possible.

Accounting Plaza (AP) is involved in finance and checks the incoming invoices. These invoices have to match to the data in Navision. *Prices difference* occur between *AIL and the TSP or vendor*. With the latter also *quantity differences* occur. Depending on the sort of difference the ILA, planner or data specialist has to deal with it.

The planner responsible for the wine assortment has to compare the actual to the forecasted demand and should *update AXIS forecasting* parameters if necessary (AXIS is a logistics management or order management tool by JF Hillebrand).

Outbound

The *outbound process* is basically transporting goods from the buffer DC to the OPCO's DC. The normal outbound process starts when replenishment orders at AIL using EDI. A planner will make arrangements with SL and Ahold transport network (ATN) to get the ordered goods to the DC in time. It occurs that sales orders (SO) are not closed when they should be. The planner has to *deal with these outstanding SO's* by finding the cause and solve it. Sometimes AIL cannot deliver ordered goods. A planner uses a *notification message* to notify the OPCO about deviations in the delivery.

Next to the normal outbound process, there are other forms of delivering goods to the OPCO's. There is the transport only order, called '*regie'*, where replenishment itself orders goods at the supplier. AIL will only arrange transport for these orders, from the supplier to the OPCO's DC. Next there is the '*dir-del*' process where a planner arranges a direct delivery. When a sales order arrives from replenishment, a planner will create a purchase order. He will arrange the goods and transport and processes both the PO and SO. Another sort of outbound process is the *sample process*. Several parties within Ahold can request samples. The process looks similar to the normal outbound process, but simplified.

During a promotion, the ILA and planner will *analyze the promotion*, e.g. whether the OPCO's order according to the agreements made with the category manager (CAM).

An OPCO sometimes detects a deviation in the delivery. They should report it to AIL within 24 hours after arrival. In this so called *lars process*, a planner should deal with the surplus or shortage in delivery.

The OPCO may request a *return shipment*. A planner will evaluate the request and if approved, arrange transport and inform SL using a sales return order.

Prices of goods in the systems of Albert Heijn (AH) and AIL should match. A data specialist checks those prices and takes action when required (*P difference AIL-AH*).

Support

Next to the main processes, there are supporting processes. Data specialists have to *update* all kinds of data and forms used at the department. An example is the *request of a package number* to create data links between different systems. Next to updating data, they are also responsible for *correcting data*. Data integrity is important and when a data related problem arises in any process, the data specialist should be involved. Some data exists in several systems and this data should always match. For this purpose, data specialists *compare source data* and solve discrepancies. An important one is the *matching of inventory*. The inventory of SL is matched against the inventory listed in Navision at AIL. Any discrepancy is reported and an assigned planner tries to solve it. If more action is required, the issue is entered into Mantis (communication tool between AIL and SL) and the ILA, planner and SL will work on it till it is resolved.

The stock level at SL should be within the margin determined in the calculation. A planner *manages inventory* and informs the ILA in case of deviations in stock or orders. Next to the stock, also some

contracts are monitored (*contract management*). An ILA checks whether there is enough volume left in the contract to deliver goods and takes appropriate action if not. For perishable goods, also the *distribution time* (DT) gets checked. The products require a minimum shelf life and for this purpose also have a distribution time in which AIL is allowed to deliver the goods to the OPCO's DC. An ILA deals with DT issues.

5.4 Review, update, analyze as-is

This section shows the resulting KPI's from the two workshops. The participants of the workshops listed their KPI's using their own wording and sometimes those KPI's were not formulated specificly. This resulted in an aggregated list of 34 KPI's, which are sorted on frequency the KPI is listed by the participants (appendix G). Together with the director and team leader of planning, five KPI's were selected. It turned out that the process orientation resulted in more usable KPI's. These KPI's are more concrete and closer related to the actual work and processes. KPI's mentioned during the dimension approach are more general and harder to express in numbers (e.g. collegiality). In general, both workshops produced KPI's relating to the five selected KPI's. The selected KPI's will be described briefly in this section. The details can be found on the performance measurement recording sheets in appendix H.

1. **% Deviation actual stock from planned stock**

This KPI measures the difference between the actual stock available at Simon Loos and the projected stock in the calculation or provided by the ILM/A in terms of percentage. The optimal stock level is determined by the IL department. The planner should adhere to this stock level and should manage the orders. Too much stock costs money, too little possibly decreases the service level.

The actual stock is available in currently existing stock overviews. The planned stock has to be supplied by an ILM/A manually as a minimum and maximum of stock weeks. The deviation is then calculated by: (actual stock – planned stock) / planned stock * 100.

2. **% Net service level per planner and category**

It measures the net service percentage delivered to the OPCO's per planner and category. The net service level is the gross service level corrected for products listed in the notification message. The gross service level is the percentage of products actually delivered versus what is ordered. Products appear on a notification message if AIL cannot deliver the specific product on the requested time. When AIL is not responsible for this delay, the amount not delivered is subtracted from the total amount not delivered. This results in the net service level.

This KPI gives insight into the performance of the planners in terms of service percentage and possibly shows room for improvement. Input for this KPI can be retrieved from existing service level overviews

and notification messages and will be calculated as follows: delivered goods (corrected) / ordered goods * 100.

3. **# Emails per category**

This KPI Measures the number of emails according to the type of content to get insight into the amount and reason of the email. A big part of the communication is via email, which consumes significant time to process. A reduction of the number of (necessary) emails and thus the spent time is desirable.

Emails should be tagged manually by a planner. This can be easily done in the new email client Gmail. Currently they still work with the old system Lotus Notes where this is not an option. The measurement of this KPI can start within a few months when the email gets transferred to Gmail. Every period, the number of emails per tag is counted and reported.

4. **# Of messages in Navision per category**

It measures the number of error messages and pop-ups and their message/reason per category/process in Navision to get insight into the amount and reason of pop-ups. Pop-ups slow down the process of the planner. Unnecessary pop-ups should be eliminated. Other pop-ups might be due to human error and can be prevented.

This can be easily counted and classified manually by a planner e.g. by using an Excel sheet.

5. **Throughput time ordering process**

This KPI measures the throughput time of the ordering process categorized and measured as explained in the calculation part of the recording sheet. This KPI is useful to get insight in the throughput time of the ordering process (categorized) to make capacity planning easier.

According to system experts this cannot be retrieved from the system. Manual measurement will therefore be used e.g. by using an Excel sheet.

Measurements

The next part gives actual measurements of the KPI applied in practice. The last three of the five KPI's rely on manual measurement. One of them also relies on the new email environment and will not be measured for this research. Due to capacity reasons the other two cannot be measured within the time limit of this research.

The data for the first KPI, '% deviation actual stock from planned stock' is retrieved from Navision and the stock level overview, and planned stock values are supplied by the ILA. In practice this data should be retrieved automatically. The KPI should be organized in a way that only specific deviations are shown in an overview to prevent for data overflow. Figure 11 shows an example of a product that is low on stock and might influence the service level. Figure 12 shows an example of a stock level between the limits and should thus not be included in the report of this KPI.

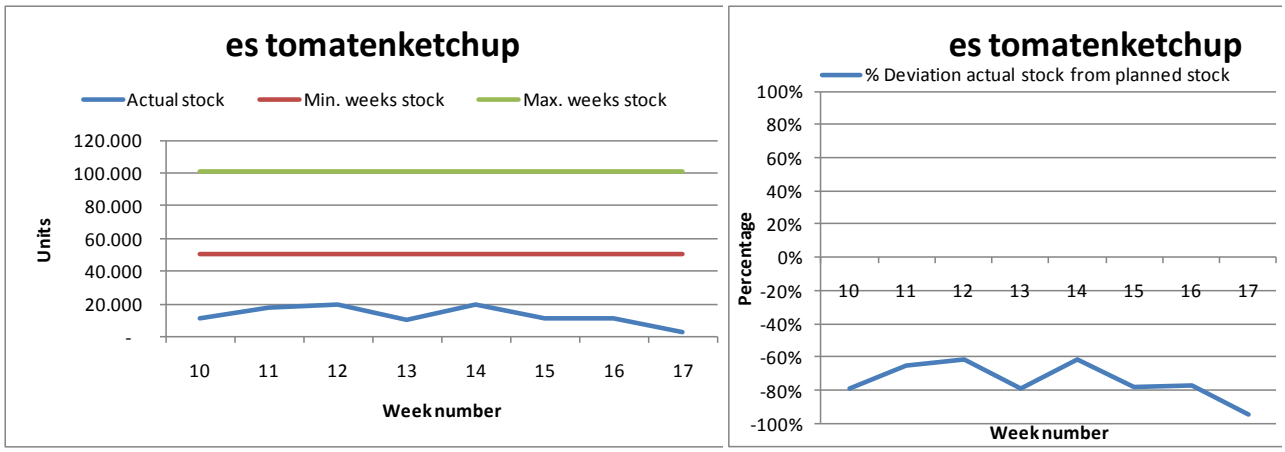


Figure 11 Product low on stock: actual stock level (left) and KPI value % deviation (right)

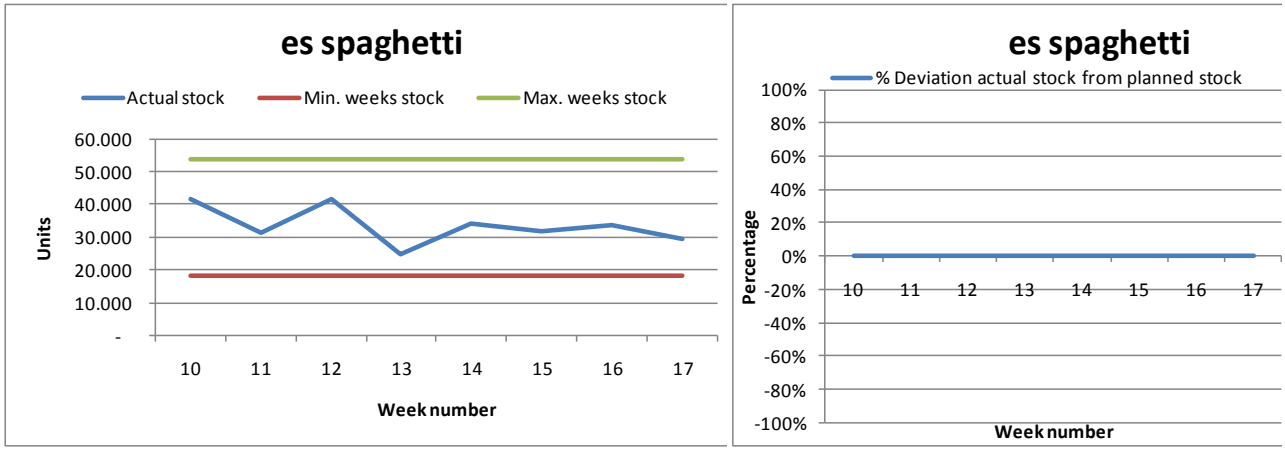
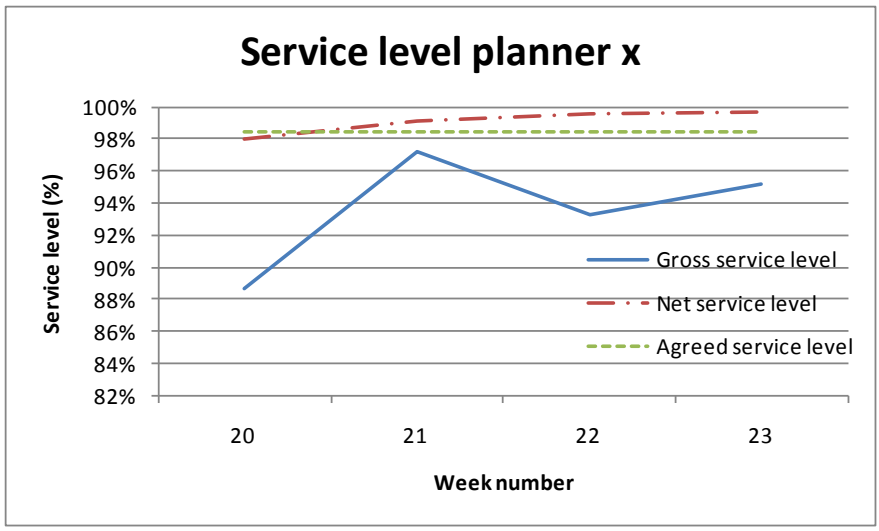


Figure 12 Product with stock level within the limits: actual stock level (left) and KPI value % deviation (right)

The data for the second KPI, % Net service level per planner and category, is retrieved from the service level overviews and the notification messages. For each planner and their categories, the products with delivery deviations (shortage) are selected. When the product appears on the notification message (for a reason the planner could not prevent), the shortage of this product does not count for the service level and is thus removed. What is left over, is the net service level. Figure 13 shows the general service level of a planner as well as specified by category.



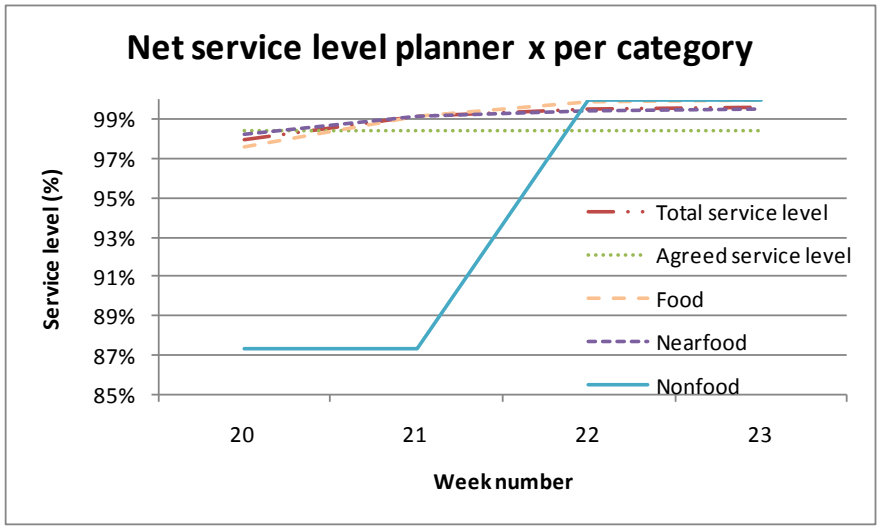


Figure 13 Service level per planner (top) and category (bottom)

5.5 Design to-be

This section describes the application of best practices to operational process at the planning department at AIL. For every KPI, the processes with the biggest impact on its value are selected from the total list of identified processes at section 5.3. On each process best practices are applied to improve performance regarding the KPI. The impact of the change is then evaluated using the KPI and the devil's quadrangle. The resulting devil's quadrangle can be found in figure 14. All 29 best practices introduced in section 2.3 are considered for every process. For the best practices not applied at the considered processes in this section, table 7 provides a general reason for its inapplicability.

Best practices
1 Control relocation: 'move controls towards the customer'
Applied.
2 Contact reduction: 'reduce the number of contacts with customers and third parties'
Applied
3 Integration: 'consider the integration with a business process of the customer or a supplier'
Applied
4 Order types: 'determine whether tasks are related to the same type of order and, if necessary distinguish new business processes'
Processes found at the planning department are relatively simple and serial. No new processes could be
5 Task elimination: 'elimintate unnecessary tasks from a business process'
Applied
6 Order-based work: 'consider removing batch-processing and periodic activities from a business process'
The processes do not contain batch processing.
7 Triage: 'consider the division of a general task into two or more alternative tasks' or 'consider the integration of two or more alternative tasks into one general taks'
All resources are more or less the same and the tasks are relatively simple and well specified. No triage is
8 Task composition: 'combine small tasks into composite tasks and divide large tasks into workable smaller tasks'
Applied
9 Resequencing: 'move tasks to more appropriate places'
All considered processes have their activities in the right order of execution. Resequencing will not gain
10 Knock-out: 'order knock-outs in a decreasing order of effort and in an increasing order of termination probability'
Processes are executed fully and do not contain any knock-out.
11 Parallelism: 'consider whether tasks may be executed in parallel'
Different actors can work parallel but within one swimminglane, one actor does the work and finishes every activity before moving to another.
12 Exception: 'design business processes for typical orders and isolate exceptional orders from normal flow'
Different orders already have their own processes.
13 Order assignment: 'let workers perform as many steps as possible for single orders'
Orders are already assigned to a single planner.
14 Flexible assignment: 'assign resources in such a way that maximal flexibility is preserved for the near future'
All planners are more or less the same and orders are assigned to a single planner. Also the work is
15 Centralization: 'treat geographically dispersed resources as if they are centralized'
All resources are in the same room.
16 Split responsibilities: 'avoid assignment of task responsibilities to people from different functional units'
Every planner is responsible for his own orders.
17 Customer teams: 'consider assigning teams out of different departmental workers that will take care of the complete handling of specific sorts of orders'
Orders are handled by a single planner.
18 Numerical involvement: 'minimize the number of departments, groups and persons involved in a business process'
Orders are handled by a single planner.
19 Case manager: 'appoint one person as responsible for the handling of each type of order, the case manager'
Orders are handled by a single planner.
20 Extra resources: 'if capacity is not sufficient, consider increasing the number of resources'
Capacity is sufficient.
21 Specialist-generalist: 'consider to make resources more specialized or more generalist'
No specialist is required. A planner should be able to execute most of the processes.
22 Empower: 'give workers most of the decisionmaking authority and reduce middle management'
AIL already has a flat hierarchy and planners already make most of the operational decision.
23 Control addition: 'check the completeness and correctness of incoming materials and check the output before it is send to customers'
Applied

24 Buffering: 'instead of requesting information from an external source, buffer it by subscribing to updates'
Information is requested from many different sources when required. Buffering is not an option for the
25 Task automation: 'consider automating tasks'
Applied
26 Integral technology: 'try to elevate physical constraints in a business process by applying new technology'
New software might be an option but for the considered processes, no new technology or software is desired.
27 Trusted party: 'instead of determining information oneself, use results of a trusted party'
Information is requested from many different sources when required and is part of the job.
28 Outsourcing: 'consider outsourcing a business process in whole or parts of it'
Outsourcing the whole department might be an option in the future. At the moment planning is only performing tasks it is supposed to do as required by Ahold
29 Interfacing: 'consider a standardized interface with customers and partners'
Applied

Table 7 Reasons for the inapplicability of specific best practices

1. % Deviation actual stock from planned stock

The value of this KPI is influenced by the actual stock level. The planned stock level is determined in advance and when set right, has no influence on this indicator. The actual stock is a result of the inbound versus the outbound stream of goods. A planner is responsible for managing this stock.

A base measurement for this KPI does not make sense because it would be very variable. The desired performance is: no deviation.

Below follows a list of the selected processes that have impact on this KPI value. On each process, best practices are applied and their impact is evaluated.

Process: Purchase order process
This process determines the inbound stream of goods and has direct impact on the stock level. Basically the most important task is to order the right amount of goods based on the best information.

Best practice:
3. Integration
Ordering goods at suppliers is a major and important task of each planner. By integrating this task into the processes of the supplier, the planner saves time. On the other hand, the supplier needs access to probably sensitive data and the supplier's organization needs to be set up for it. This makes this best practice less realistic in this situation. Although, for bigger and reliable suppliers, this would be an option.

23. Control addition
When evaluating the order suggestion, all the required input should be readily available within Navision. E.g. a graph like figure 12 gives information about the actual and planned stock. Also irregularities in stock changes due to e.g. increased demand should be included. With the right and accurate data the stock can be managed optimally.

25. Task automation
The creation of shipments should be done automatically when an order is released in Navision. The feedback from the supplier should automatically be processed. For EDI enabled suppliers this is mostly automated already.

Process: Deal with outstanding PO's
Goods not received on time may cause a deviation in actual from planned stock and eventually, delivery problems. The best option is to avoid outstanding PO's. This can be done by selecting reliable suppliers and make good agreements. Unfortunately this is done by other parties and when delays occur, it is beyond the power of the planner.

Best practice:
5. Task elimination
Creating an overview of outstanding purchase orders and then checking it with Simon Loos causes extra work. One option is to let SL make an overview and send it on regular times. The other option is to create it at AIL but for this, the data should be up-to-date and complete.

25. Task automation
Every time the goods are late and in transit, a planner has to request the delivery date and reason from a TSP. On creation of the overview of outstanding PO's a message to the concerning TSP's could be send automatically. Or even the overview can be left out.

Process: PO wine overseas
This is the purchase order process for wines from oversea. Getting the orders right is the most important task of this process.

Best practice:
2. Contact reduction
By reducing contact with the consultant from Hillebrand time can be saved. The quality of the orders may decrease as a consequence.

23. Control addition
The same application of this best practice as explained earlier at the Purchase order process.

29. Interfacing
Currently, a consultant has to enter an order into AXIS while a planner at AIL enters the same order into Navision. This is unnecessary. By making an interface, the order has to be entered in one system only and gets copied to the other system automatically.

Process: Promotion analysis
Sometimes AIL runs out of stock because of an increased demand during a promotion event. This should be avoided.

Best practice:
23. Control addition
Explicitly check for increased demand during a promotion event and its impact on the stock and future delivery performance. This information can then be used to take appropriate action.

Basically, ordering the right amount of products and receiving those products on time are the most important for this KPI. For this purpose, the right and up-to-date data in required. The above mentioned best practices likely lead to better quality decisions on order size and time reduction in the processes. Automation and task elimination will lead to lower cost in the long term. Also a better stock level will be better for AIL financially. The process integration and task automation might lead to a decreased flexibility. The deviation of the actual stock from the planned stock will decrease.

2. % Net service level per planner and category

The value of this KPI is influenced by how well a planner manages his stock and how well he delivers goods when ordered. The demand comes from an external party (replenishment) and cannot be influenced. Although demand is forecasted and included in the ordering. The stock level is important and makes this KPI related to the previous KPI.

This KPI is variable but as a base measurement, the current net service levels can be used. Figure 13 gives an example of the net service level measurement. The target value for this KPI is a percentage of at least 98,4.

Below follows a list of the selected processes that have impact on this KPI value. On each process, best practices are applied and their impact is evaluated.

Process: Purchase order process
Like the previous KPI (one) the stock level is important. Generally, when the stock level is within the planned levels it should be fine. The best practices applied to this process at the previous KPI also apply for this KPI.

Process: Deal with outstanding SO's
When an outstanding sales order is not processed properly, an operating company might not receive the order. This could decrease the service level of AIL to that OPCO. On time detection and processing of these outstanding SO's is therefore desired.

Best practice:

1. Control relocation

At the moment, a planner checks for outstanding SO's and contacts Simon Loos. To detect the problem earlier, SL could contact AIL as soon as they detect a problem with a sales order. This saves time for the planner and the problem is detected earlier.

Process: Notification message

The net service level is determined by using the shipped versus ordered overview corrected with the data on the notification message. The quality and completeness of this message is important for the net service level.

Best practice:

8. Task composition

The quality of the notification message is already guaranteed by this process but some time can possibly be saved. By combining task two (process delivery deviations in notification message) to five (complete entries with missing data and notify team leader) setup times might be avoided. In practice this set of tasks is mostly already done in succeeding order.

Much of the suggested improvements are time related but also on the quality dimension, improvements can be expected. The KPI value is mostly influenced by the stock management.

3. # Emails per category

Processing email takes time so unnecessary emails should be avoided. An email may follow on an action of a planner or can be triggered by external factors. Actions of planners that trigger an unnecessary email should be detected and eliminated from the concerned process. Also third parties should be instructed to only send email that is desired or required by the department. The initial use of this KPI is to classify these emails to get insight into the stream of emails. Further use can be to reduce the amount of email.

After classification of the email, a base measurement can take place. With this information a target performance can be set. A fixed value cannot yet be determined but the trend of the value should be decreasing.

Process:

Email follows from most of the processes a planner is concerned with or is triggered by an external factor. Therefore specific operational processes cannot be selected for improvement.

Best practice:

For email communication in general, some best practices can be applied.

2. Contact reduction
Less email to read and process saves time. This means that a planner should avoid triggering unnecessary email from other parties and other parties should be instructed to only send required email.

25. Task automation
Sending, receiving and processing data automatically saves time. It requires a high level of standardization, and technology should be available at all the involved parties. AIL already uses EDI in several cases.

29. Interfacing
Similar to the previous best practice. Standardize the way of communication. An example is the use of Mantis at AIL where email is replaced by a format dedicated to stock problems between AIL and SL.

This improvement leads to better quality email and saves time for the planner. The KPI value should decrease.

4. # Of messages in Navision per category

At the moment, when working in Navision a planner gets interrupted by several messages or pop-ups. Some of them are informative and desired but others slow down the process. By measuring this KPI, insight into the reasons and amount of pop-ups is gained. This KPI should not be measured frequently but only on major process or systems changes. Unnecessary messages can then be removed. Also planners should be instructed how they can avoid these pop-ups. A minor time reduction can be expected.

The base measurement will be the initial measurement but is not very useful as the target is to remove all unnecessary pop-ups.

Process:
No specific processes can be selected for this KPI. All processes that include working in Navision are part of the measurement.

Best Practice:
No best practice can be used to improve processes regarding this KPI.

5. Throughput time ordering process

Ordering is one of the major tasks of a planner. To improve capacity planning, insight into the throughput times of this process is desired. By measuring this KPI, insight on throughput times is gained e.g. per planner, category, (origin of) supplier, transportation mode, and order composition. The result

makes capacity planning, evaluation, and comparison easier. The throughput time can be reduced by working faster, streamlining the process or plan the work more efficient.

After a certain period of time the measurements will average out. This will be the base measurement. As mentioned before, this will be used for capacity planning. But also targets can be set for performance improvement.
Below follows a list of the selected processes that have impact on this KPI value. On each process, best practices are applied and their impact is evaluated.

Process: Purchase order process
At KPI one it was important to improve the quality of this process. For the current KPI it is more important to improve the time dimension. The suggestions given at KPI one are also applicable for the current indicator.

Best practice:
3. Integration
Let capable and trusted suppliers manage AIL's stock of their products. This will save time for AIL. AIL will lose a bit of control and should give access to a lot of data. The negative side is a decreased flexibility.

25. Task automation
The evaluation of the order suggestion costs time. By implementing algorithms and decision rules this can be automated. This will save time but the quality and flexibility might decrease. Also the creation of the shipment is mostly done manually. Navision should give suggestions or do it automatically. In the extreme case the whole process can be automated but this requires the right technology and software, and a high level of standardization and predictability. This is not a realistic option at the moment.

Process: PO wine overseas
Again this process is discussed at KPI one but now the focus is on the time dimension.

Best practice:
2. Contact reduction
As mentioned, less time communicating and discussing with a consultant saves time.

Both 3. integration and 25. task automation apply to this process in the same way it did to the previous process.

29. Interfacing
As suggested at KPI one, AXIS and Navision should get an interface to redundant work can be avoided.

Process: PO non-food

Non-food goods mostly origin from Asia and the process contains more communication than the normal purchase order process. It does not include forecasting since the whole contract volume gets ordered at once.

2. Contact reduction

The Asian market is hard to conduct business with. This is the reason there is a lot of communication between AIL and the supplier. At the moment, contact reduction is not an option but in the future it might be. AIL should find reliable and trustworthy suppliers.

5. Task elimination

Some checks in the process e.g. requesting actual specifications should not be necessary. Eliminating these checks relies on reliable and trustworthy suppliers. Eliminating these tasks subsequently leads to contact reduction.

The aim of the applied best practices is to improve performance of the time dimension. In most cases this leads to a decreased quality and flexibility. The throughput time will decrease.

Figure 14 gives a graphical evaluation of the applied best practices by using the devil's quadrangle.

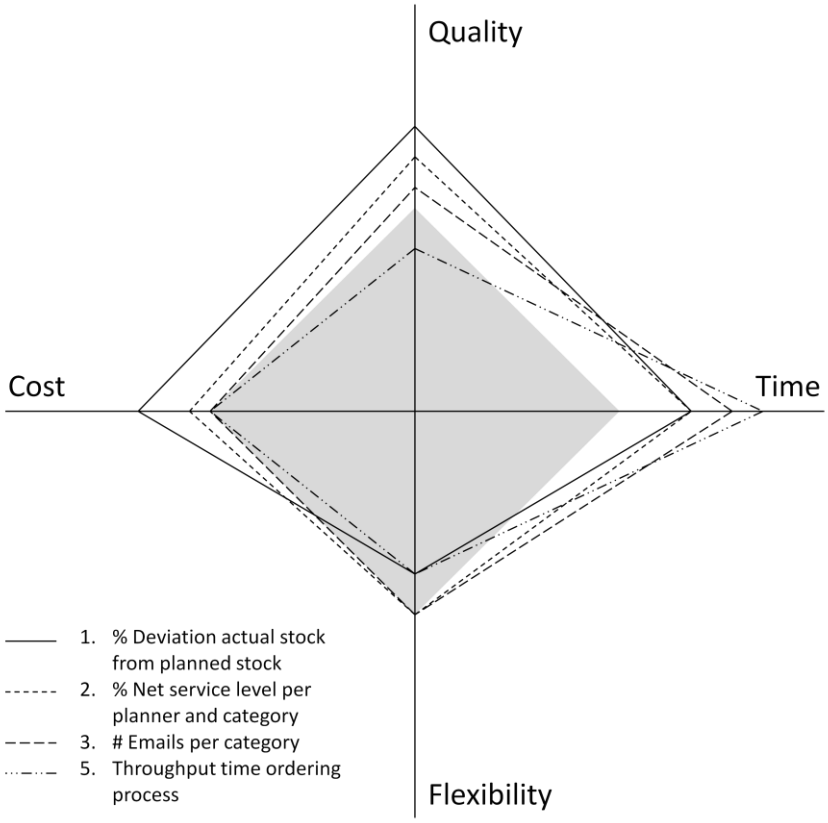


Figure 14 Evaluation of the suggested best practices

5.6 Conclusion case study

The operational processes are identified using internal documentation and by interviewing employees at AIL. These are then modeled using BPMN. The operational processes at AIL can be characterized as short processes with only a few short tasks. They are repeated frequently and contain only a few participants. AIL can use the models for communication, analysis, and improvement purposes.

Two workshops are carried out to gather and select five KPI's for the planning department. Some KPI's are more general, to gain insight in the current performance, and are not specific for one process. Others are more specific for a process and can be used for continuous measurement. The KPI gathering technique used, a workshop, worked well. It improved employee involvement and resulted in numerous KPI's.

The results of the process oriented workshop were best. This indicates that it is easier for the employees to think in terms of actual work instead of thinking in an abstract way about it. Although, there is no data to justify this conclusion. In this case, it turned out that the dimension way of thinking used in literature is a good way to classify KPI's but is not practical for use in practice and should not be used solely. AIL can use the process oriented workshops to gather KPI's for all their departments.

For two out of five KPI's base measurements are carried out and for all of them, targets are set. These performance indicators are used to select processes for redesign. Best practices are then applied to improve the performance regarding the accompanying KPI values. For the planning department and the corresponding processes, most best practices are not applicable.

Notable is the frequent use of task automation, which one should be careful with. Automation seems like an easy solution but it requires standardization and the technology should be available and ready. Also the process should be optimal before automating a less than optimal process.

No improvement suggestions were actually implemented so no conclusion can be drawn on the applicability and impact of those suggestions.

6 Conclusion, discussion and limitations

This study looked at the application of the business process reengineering cycle, based on key performance indicators. Activities per step of the cycle are determined and tested, conducting a case study at Ahold Inbound Logistics where the focus was on business process modeling, KPI determination and application of best practices. This research helped to answer the research questions:

How can the business process reengineering cycle, based on key performance indicators, be equipped to improve the performance of operational processes?

The BPRC consists of four steps. The first three steps are elaborated on but due to time limitations, the fourth step was outside the scope of this project.

The determined activities for the first step, identifying as-is processes, worked well in practice. All common processes were identified, modeled using BPMN, and validated. As stated in a referred paper, this study confirms that a limited use of BPMN elements is appropriate for communication and analysis purposes.

The second step of review, update and analyze as-is processes is carried out by determining and measuring key performance indicators. KPI's work well in measuring process performance but for a complete analysis of a process, other analysis techniques might be useful. The approach for determining the KPI's, workshops, worked well in practice and resulted in useful KPI's. It seems that the process oriented brainstorm resulted in more useful KPI's but this cannot be justified with data. The gathered KPI's during the session were not specified well enough to make clear distinctions between some of them. Additionally only one session per orientation took place with only a few participants so no conclusions can be drawn. The dimension way of thinking used in literature is a good way to classify KPI's but seems not practical for use in practice and should not be used solely.

Furthermore the performance measurement recording sheet works well in practice and makes sure the KPI's are defined well.

Designing the to-be processes is step three of the BPRC. In this research this is done by applying best practices found in literature. These best practices give good guidance for suggesting improvements in processes. In practice many of them were not applicable, probably depending on the business environment and complexity of the processes. Out of the 29 best practices found in literature, only a limited set of eight practices, five frequently, is used. These do not correspond to the top ten found in literature. Notable is the frequent use of task automation, which one should be careful with. Automation seems like an easy solution but it requires standardization and the technology should be available and ready. Also the process should be optimal before automating a less than optimal process.

Overall, the proposed method works well for an environment like AIL: a small department with only little hierarchy, and short processes. Meaning the business process reengineering cycle, as limited as it is, and the activities per step are appropriate. This approach can be used for similar environments. Although the

use of solely KPI's and or solely best practices might limit the result. The use of other or complementary techniques might be interesting and should be investigated.

Limitations

This study has the following research limitations.

Since this study lacks implementation of the proposed process improvements, nothing can be said about the feasibility and result of these suggestions.

For validation of the BPRC and the proposed activities per step, step 4 needs to be applied and more case studies should be conducted. Also other activities or techniques might be added to compare approaches.

The redesign part of this study focuses on the performance improvement regarding a single KPI. In practice it is more useful to look at a range of processes and involve more KPI's, thus a broader view on performance. Also improvement efforts should be directed by expected results and improvement priorities at the department.

Due to the limited number of involved processes in the redesign phase, no real judgment can be given on the quality and use of the best practices.

It should also be mentioned that using best practices is just one of the methods and is limited to relatively small improvements. The use of other techniques might be useful.

More workshops with the two different orientations should be carried out to draw conclusions on quality and usefulness of both.

This study has the following practical limitations.

Ahold Inbound Logistics is a rapid changing department. Identified and modeled processes will become outdated unless frequently updated and revised.

Most of the five selected KPI's rely on manual measurement, which in practice, turns out, are not measured due to resource limitations. Resources should be (partly) dedicated to measuring performance or KPI's should be chosen for which manual measurement is not required. Furthermore, the measurements done were time intensive. For practical use, time needed for the measurement and reporting of KPI's should be kept to a minimum.

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Appendix A: List of figures, tables and abbreviations

List of Abbreviations

Abbreviation	Description
AES	Ahold European Sourcing
AH	Albert Heijn
AIL	Ahold Inbound Logistics
AP	Accounting Plaza
ATN	Ahold Transport Network
BPI	Business Process Improvement
BPMN	Business Process Modeling Notation
BPR	Business Process Redesign
BPRC	Business Process Reengineering Cycle
CAM	Category Manager
DC	Distribution Center
DT	Distribution Time
EDI	Electronic Data Interchange
ERP	Enterprise Resource Planning
ILA	Inbound Logistic Assistant
ILM	Inbound Logistic Manager
KPI	Key Performance Indicator
OPCO	Operating Company
PI	Performance Indicator
PM	Performance Measure
PO	Purchase Order
SL	Simon Loos
SMART	Specific, Measurable, Attainable, Realistic, Timely
SO	Sales Order
TSP	Transportation Service Provider

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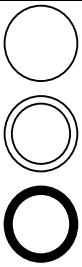
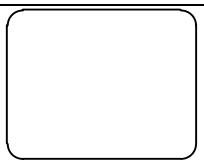
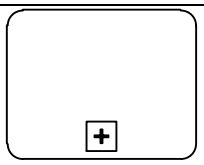
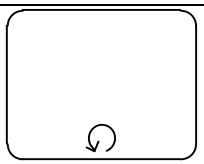
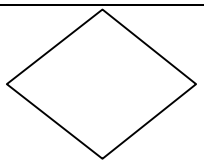
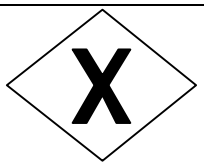
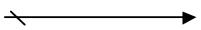
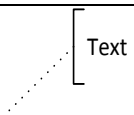
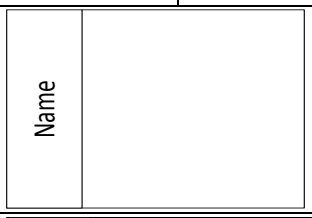
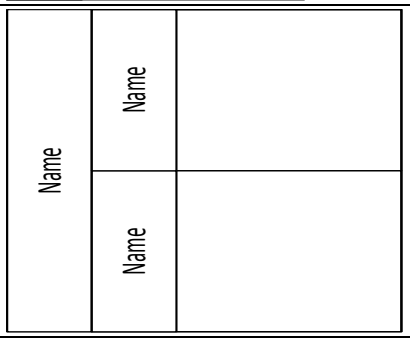
Appendix B Business Process Modeling Notation (BPMN)

Basic elements BPMN

Descriptions are quoted from: (1) (White, 2004) or (2) (Object Management Group, 2010)

Element	Description	Notation
Event	An Event is represented by a circle and is something that "happens" during the course of a business process. These Events affect the flow of the process and usually have a cause (trigger) or an impact (result). Events are circles with open centers to allow internal markers to differentiate different triggers or results. There are three types of Events, based on when they affect the flow: Start, Intermediate, and End. (1)	
Type dimension: message	The Start and some Intermediate Events have "triggers" that define the cause for the Event. The one on the right is triggered by a message. (2)	
Activity	An Activity is represented by a rounded-corner rectangle and is a generic term for work that gets performed. An Activity can be atomic or nonatomic (compound). The types of Activities are: Task and Sub-Process. The Sub-Process is distinguished by a small plus sign in the bottom center of the shape. (1)	
Collapsed sub-process	The details of the Sub-Process are not visible in the Diagram. A "plus" sign in the lower-center of the shape indicates that the Activity is a Sub-Process and has a lower level of detail. (2)	
Activity looping	The attributes of Tasks and Sub-Processes will determine if they are repeated or performed once. There are two types of loops: Standard and Multi-Instance. A small looping indicator will be displayed at the bottom-center of the activity. (2)	
Gateway	A Gateway is represented by the familiar diamond shape and is used to control the divergence and convergence of Sequence Flow. Thus, it will determine traditional decisions, as well as the forking, merging, and joining of paths. Internal Markers will indicate the type of behavior control. (1)	
Exclusive gateway	Icons within the diamond shape of the Gateway will indicate the type of flow control behavior. The types of control include: • Exclusive decision and merging. Both Exclusive and Event-Based perform exclusive decisions and merging. Exclusive can be shown with or without the "X" marker. (2)	
Sequence flow	A Sequence Flow is represented by a solid line with a solid arrowhead and is used to show the order (the sequence) that activities will be performed in a Process.	

	Note that the term “control flow” is generally not used in BPMN. (1)	
Default flow	For Data-Based Exclusive Gateways or Inclusive Gateways, one type of flow is the Default condition flow. This flow will be used only if all the other outgoing conditional flow is not true at runtime. These Sequence Flows will have a diagonal slash added to the beginning of the connector (2)	
Message flow	A Message Flow is represented by a dashed line with an open arrowhead and is used to show the flow of messages between two separate Process Participants (business entities or business roles) that send and receive them. In BPMN, two separate Pools in the Diagram will represent the two Participants. (1)	
Association	An Association is represented by a dotted line (with a line Arrowhead) and is used to associate data, text, and other Artifacts with flow objects. Associations are used to show the inputs and outputs of activities. (1)	
Data Object	Data Objects are a mechanism to show how data is required or produced by activities. They are connected to activities through Associations. (1)	
Annotation	Annotations are a mechanism for a modeler to provide additional text information for the reader of a BPMN Diagram. (1)	
Pool	A Pool represents a Participant in a Process. It also acts as a graphical container for partitioning a set of activities from other Pools, usually in the context of B2B situations. (1)	
Lane	A Lane is a sub-partition within a Pool and will extend the entire length of the Pool, either vertically or horizontally. Lanes are used to organize and categorize activities. (1)	

Appendix C Interviewees

				Phase				
First name		**Last name**	**Function**	**Problem statement**	**Process modelling**	**Model validation**	**KPI workshop process**	**KPI workshop dimension**
Bert	van	Dijk	Director Ahold Inbound Logistics	V			V	
Thomas		Dijkstra	Data Specialist	V	V	V		
Jan		Altelaar	Data Specialist		V	V		
Marco		Barneveld	Inbound Logistic Assistant Non-food	V	V	V		
Roel		Verhoeven	Business controller	V				
Marco	van der	Kamp	Teamleader planning	V		V	V	V
Tom		Jesserun	Planner Non-food		V	V	V	
José		Membrilla	Planner food and near-food		V		V	
Liselore		Halink	Inbound Logistic Assistant Wine		V			
Jurn		Walstra	Planner wine (outside Europe)		V	V		V
Jasper		Frohlich	Planner food and near-food		V	V	V	
Janne	van der	Puij	Planner food		V			V
Paul	van der	Pal	Planner non-food and near-food		V	V		V
Daniël		Fritschy	Inbound Logistic Assistant Food		V	V		
Wendy		Mandjes	Data Specialist		V	V		
Jeroen		Hirdes	Inbound Logistic Manager Food		V			
Arnold	ten	Pas	Inbound Logistic Manager non&near-food		V			
Marina		Kirilishina	Planner wine (inside Europe)		V			
Huub		Klos	Planner				V	
Ilona		Papo	Planner					V

Appendix D Interview protocol

Name:
Function:
Date:

Overview processes
[A list of processes this interviewee is expected to be involved in, created in advance]
Ask the interviewee to complete this list

Items to cover for each process
Who/What triggers the activity/process (initiator)?
Who are the actors?
What events occur?
What activities are performed (and in what order)?
What is the input of the activity/process?
What is the output of the activity/process?
What data is communicated and how (EDI, mail, verbal, paper etc.)?
What is the data format and format changes occur (interfaces)?
Who is responsible for the process/activity?
What IT/software is used in the activity?
How do they interact with the IT/software (manual or automated)?
What part/functionality of Navision is used, if applicable?
What are common errors/exceptions?

Appendix E Overview process model validation

	Marco vd Kamp	Tom Jessurun	Jasper Frohlich	Paul van der Pal	Jurn Walstra	Thomas Dijkstra	Jan Altelaar	Wendy Mandjes	Daniel Fritschy	Marco Barneveld
Calculation						V	V		V	V
High-level negotiations and calculations									V	V
Sample process	V		V		V					
New product						V	V			
New vendor							V			
Update general						V	V			
Contract management									V	V
Dir-del	V	V	V	V	V					
Forecasting product profile	V	V	V	V	V				V	V
Inventory management	V	V	V	V	V				V	V
Promotion analysis	V	V	V		V				V	V
Promotion event	V	V	V		V				V	V
Correcting data						V	V			
Deviant PO before shipment	V	V	V	V	V					
PO non-food	V	V		V	V					
P-Q difference AIL-vendor	V	V	V	V	V				V	V
Purchaseorder process	V	V	V	V	V					
Deal with outstanding POs	V	V	V	V	V					
Deviant PO in transit	V	V	V	V	V					
P difference AIL-TSP							V			
PO Wine overseas					V					
Regie	V	V	V		V					
Transit status	V	V	V	V	V					
Update AXIS forecasting					V					
Breakage inbound-before unloading	V	V	V	V	V				V	V
Compare sourcedata							V	V		
Container form							V	V		
Deviant PO receipt	V	V	V	V	V					
Distribution time									V	V
Inventory matching- Issues raised at SL	V	V	V	V	V				V	V
Preliminary notification	V	V	V	V	V					
Deal with outstanding SOs	V	V	V	V	V					
Lars process	V	V	V		V					
Notification message	V	V	V	V	V					
Outbound	V	V	V	V	V					
P difference AIL-AH							V		V	V
Request package numbers							V			
Return shipments	V	V	V		V					

Appendix F Process models

Deleted due to confidentiality reasons

Appendix G Overview KPI's

Position	Frequency	KPI
1	6	(Average) stock level per product, cost
2	4	Processing time processes/actions (Nav). System/software performance
3	3	# of error messages/pop-ups (Nav)
4	3	Data integrity, 3-way check
5	3	Throughput time (general, issues)
6	3	Productivity (quality cost) (2 times Marco)
7	3	Stick to procedures
8	3	Timeliness (On-time data flow)
9	2	Deviation actual booking (in/out) from order
10	2	# of alterations per order (causer)
11	2	Timeliness, waiting time TSP
12	2	Availability
13	2	Flexible organization
14	1	(Inbound) ordering
15	1	On-time order processing
16	1	# of return shipments
17	1	capacity utilization at SL
18	1	# of deviating pallet stackings
19	1	Turning point order size vs cost
20	1	# of deviations from the inbound scheme
21	1	# of events added per week, time (automatically)
22	1	# of deviations per delivery, per supplier
23	1	On-time supply of orders by OPCO
24	1	# of identical orders (truck size)
25	1	# of load bearers per order, by format, cost
26	1	# of issues (and quality)
27	1	Collegiality
28	1	Stock difference
29	1	Service percentage, reliability
30	1	Issue processing, Mantis, AP
31	1	Quality of in/outbound flow processing
32	1	Improvement, change, trend AIL
33	1	Stock quality
34	1	Source data quality

Appendix H Performance measurement recording sheets

Ahold Inbound Logistics KPI measurement sheet

Name

% Deviation actual stock from planned stock

Department
Planning

Explanation

Definition

This KPI measures the difference between the stock available at Simon Loos and the projected average stock in the calculation or provided by the ILM/A in terms of percentage.

Purpose

The optimal stock level is determined by the IL department. The planner should adhere to this stock level and should manage the orders. Too much stock costs money, too little possibly decreases the service level.

Relates to

This relates to the goal of AIL: 'to provide the Ahold brands maximum product availability against the lowest costs'

Calculation

Subordinate measures used for calculation

A = Stock level at SL
B = Projected stock in calculation

Calculation formula	Formula type	Unit type
(A - B) / B * 100	Rate	%

This KPI should be **categorized** by planner, category and product.
Possibly **remove** the Promotion orders

Target

Target and timescale	Trend is good when
Not yet available	Decreasing

Data profile

Who owns the measure	Who measures	Source of data
ILA	ILA/Teamleader planning	Calculation sheet IL Inventory overview

Data capture period	Standard reporting frequency
Week	4 weeks

Who acts on the data and what do they do

The teamleader will ask the responsible planner for an explanation. The planner should adapt his ordering so the deviation will get below 5%. If necessary, an ILA should be involved.

Notes and comments

On evaluating the service level, attention should be payed to the assortment of the planner. This measure is intended to direct planners, not to evaluate their performance.

Ahold Inbound Logistics KPI measurement sheet

Name

% Net service level per planner and category

Department
Planning

Explanation

Definition
It measures the net service percentage delivered to the OPCO's per planner and category

Purpose
This KPI gives insight into the performance of the planners in terms of service percentage and possibly shows room for improvement.

Relates to
This relates to the goal of AIL: 'to provide the Ahold brands maximum product availability'

Calculation

Subordinate measures used for calculation
A = goods delivered to OPCO per planner per period
B = goods ordered by the OPCO per planner per period (corrected for net service level)

Calculation formula	Formula type	Unit type
A / B * 100	Rate	%

This calculation should also be applied per category.

Target

Target and timescale	Trend is good when
> 98.4% within 6 months	Increasing

Data profile

Who owns the measure	Who measures	Source of data
Teamleader planning	Automatic	Delivery reports Order overview OPCO's

Data capture period	Standard reporting frequency
Week	4 weeks

Who acts on the data and what do they do
The planner should get his service level to at least 98.4%. The teamplanner should discuss the service percentage in case of irregularities or periodically.

Notes and comments

On evaluating the service level, attention should be payed to the assortment of the planner.

Name

Emails per category

Department
Planning

Explanation

Definition
Measures the number of emails according to the type of content

Purpose
To get insight into the amount and reason of the email. A big part of the communication is via email which consumes significant time to process. A reduction of the number of (necessary) emails and thus the spent time, is desirable.

Relates to
Reducing processing and also throughput time leads to decreasing cost.

Calculation

The following data/categories should be recorded for each email
Informative email, no action required
Action required, internal factor
Action required, external factor
Unnecessary

The number of emails can be derived from this categorization

Target

Target and timescale
Reduction of the number of emails
Not yet available

Trend is good when
Decreasing

Data profile

Who owns the measure
Teamleader planning

Who measures
Planners

Source of data
Corporate email system

Data capture period
Continuous

Standard reporting frequency
4 weeks

Who acts on the data and what do they do
Teamleader planning should detect exceptional high amounts of email and should direct a planner to find and possibly solve the cause.

Notes and comments

Base values should be determined before targets can be set. Also there might be a good reason for an above average amount of email. The number on itself does not tell the whole story, the cause should always be determined. Additionally, categorization of the email can be subjective.

Name

Of messages in Navision per category

Department
Planning

Explanation

Definition
Measures the number of error messages and pop-ups and their message/reason per category/process

Purpose
To get insight into the amount and reason of pop-ups. Pop-ups slow down the process of the planner. Unnecessary pop-ups should be eliminated. Other pop-ups might be due to human error and can be prevented.

Relates to
Decreasing processing times lead to lower cost

Calculation

The following data/categories should be recorded for each message
The error/pop-up message (during importing, exporting and in-process)
The process/task in which the message shows up

This leads to both the number of messages per category and process.

Target

Target and timescale
Not yet available

Trend is good when
Decreasing

Data profile

Who owns the measure
Teamleader planning

Who measures
Planners

Source of data
Navision

Data capture period
Continuous

Standard reporting frequency
4 Weeks

Who acts on the data and what do they do
Teamleader planning should detect unnecessary pop-ups and should discuss with Qurius consultants whether they can be deleted/suppressed. Pop-ups due to human error should be handled by the responsible planner.

Notes and comments

For each message, the cause should be determined to get insight into possible improvements and responsible parties.

Name

Throughput time ordering process

Department
Planning

Explanation

Definition
Throughput time of the ordering process categorized and measured as explained below in the calculation part.

Purpose
To get insight in the throughput time of the ordering process (categorized) to make capacity planning easier.

Relates to
The gained insight can be used to decrease throughput time, increase productivity and capacity utilization (staffing) which leads to lower cost.

Calculation

Definition of the process and categories
The process **starts** when AFP or the AXIS ordering screen is active.
The process **ends** when the transport order is sent.

The following categories should be recorded for each transport order

Throughput time	Name of the planner
Product category	Supplier
Used forecasting method (AFP/AXIS/graph)	Truck allocation method: AFP or Excel
Transportation mode: road or sea	# Of different products per order
Regular or promo order	# Of trucks

Target

Target and timescale
Not yet available

Trend is good when
Decreasing

Data profile

Who owns the measure	Who measures	Source of data
Teamleader planning	Planner	Planners, Navision, AXIS

Data capture period	Standard reporting frequency
Continuously, periodically	Periodically

Who acts on the data and what do they do
The teamleader planning can better plan his capacity at disposal. He can also detect peaks in the throughtput times and discuss it with the concerning planner.

Notes and comments

Data measured is possibly subjective and or biased but long-term values will give a good average. All kind of interruptions occur which influence the throughput time, these are not taken into account. This measure should not be used as a hard performance measure.