Creating Transparency in Resource Utilization and Flexibility of DHL Express NL
Towards Structural Resource Monitoring and Management

Ivette van Wijgerden
Delft University of Technology &
DHL Express NL
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Towards Structural Resource Monitoring and Management

Ivette van Wijgerden
1219618
i.j.vanwijgerden@gmail.com

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Msc. Transport Infrastructure and Logistics
Delft University of Technology

Members of the thesis committee:

Prof. Dr. Ir. L.A. Tavasszy
Delft University of Technology,
Faculty of Technology, Policy and Management

Ir. M.W. Ludema
Delft University of Technology,
Faculty of Technology, Policy and Management

Dr. Ir. H.P.M. Veeke
Delft University of Technology,
Faculty of Mechanical, Maritime and Materials Engineering

Ir. E.M. van Tol
DHL Express NL,
Ground Operations Manager North

Delft University of Technology and DHL Express NL
Editorial note

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Creating Transparency in Resource Utilization and Flexibility of DHL Express NL

Delft University of Technology and DHL Express NL
Preface

In December 2009, a seminar at DHL Express in Den Haag aroused my interest in the company. The field of logistics always draws my attention, the seminar case was interesting and the employees were friendly and passionate: it led to the start as a graduate at DHL Express NL in May 2010. This report is the result of the graduation project of the Master Transport, Infrastructure and Logistics of the Delft University of Technology.

I am very thankful that DHL Express NL offered me the possibility to do my graduation project at DHL and that they shared the problem of the lowering volumes and resource utilization with me. I had a great time, because of all the employees that were as kind as they seemed during the seminar and I really learned a lot. Now the project has come to an end and I would like to thank all the DHL employees that supported me, provided me with information and kept me motivated. Especially, I would like to thank Wilfried for his ongoing support in the construction of the dashboard and the most when I considered throwing my laptop out of the window. Furthermore, I would like to thank Henrik for his excellent feedback skills and his contribution as Operations management team member. I would also like to thank the terminal Den Haag for their hospitality and conviviality.

Last but not least I would like to thank the Operations management team for their time and enthusiasm during the feedback sessions, despite of their very busy schedules. The feedback sessions were of great importance to let this project succeed.

Next to DHL, I would like to thank my thesis committee that guided me through the adventure of graduation. First, I would like to thank Professor Lorl Tavasszy for his constructive criticism during the meetings with the thesis committee. Second, I am thankful for the guidance of my supervisors Marcel Ludema and Hans Veeke, who helped me out from respectively the TPM perspective and the Mechanical Engineering perspective. The meetings kept me motivated and really helped me structuring my thoughts. Finally, I would like to thank Erik van Tol for his guidance. I really appreciated our meetings that were very useful, interesting and informative, since he also taught me some life lessons as well.

Finally I would like to thank my friends and family for their mental support and faith and especially Maayke for reading and commenting on the report. The final words of saying thank you go to Joost, who was the mainstay during the project and did a great job on reviewing at the end of the project.

Additionally, I would like to wish the Operations management team good luck with using of the dashboard and Gert with maintaining the dashboard. Personally, I am proud of the result and I hope the dashboard will contribute to great successes.

Ivette van Wijgerden

31 januari 2011
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Delft University of Technology and DHL Express NL
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Summary

Introduction
DHL is a large player in the international express industry. According to the Cambridge Advanced Learner's Dictionary the word 'express' means "a service which does something faster than usual". At the moment, the global market is dominated by four express providers, also known as (global) integrators or global logistics providers. DHL Express is one of them. The company transports goods from an origin to a destination location. This process is executed by means of a network and resources, like employees, vehicles and buildings.

In the Netherlands, DHL Express lost a lot of volume the previous years: the amount of shipment decreased by from 2007 to 2010. The management team of the Operations department of DHL Express assumes that the decreased volume negatively influences the profit margin.

The three underlying aspects of the profit margin are the costs on the one hand and the tariffs and volume on the other hand. It is important to keep the costs as low as possible in order to improve the profit margin. However, this is difficult, since DHL Express NL owns an extensive network with many resources, which means that the fixed costs form a significant part of the total costs. The costs can be cut to a certain level, but cannot be cut any further, since the service performance is brought into question.

The other aspects are tariffs and volume. As explained, the volume has decreased the previous years. Next to this decrease, the tariffs are lowered to competitive tariffs as well, since low costs Express providers entered the market and caused a strengthening of competition. Competitive tariffs and decreased volumes have led to a decreased revenue.

The lowered amount of volume and the extensive network of resources probably cause a low utilization of these resources. In addition, the revenue has been decreased by the competitive tariffs. The high fixed costs of the extensive network and the lowered revenue put pressure on the profit margin.

At the moment, transparency in the performance of resource utilization is lacking for DHL Express NL. This lack of insight makes it difficult to take the right management decisions about resource management. The performance of resource utilization is monitored ad hoc in case of problems, but a structural way of monitoring is missing.

Furthermore, the flexible part of the resource utilization is unknown by DHL Express NL. In general, it is always preferable to have a flexible part, which is able to absorb the volume changes. Flexibility influences the fixed cost part of the total costs and therefore it makes it easier to keep the profit margin at a desired level.

The opaqueness of the performance on resource utilization and flexibility led to the following project objectives:

1. Create transparency about the resource utilization and flexibility at DHL Express NL by means of a dashboard
2. Embed the dashboard into the Operations department to support the managers on medium long term decisions

In order to take decisions on the medium long term, which is defined as 1 to 1.5 year, the Operations management team is not only interested in the current situation of the resource performance, but also in possible future situations. In addition, it is important that this dashboard is corresponding with the preferences and requirements of the Operations management team, since this group of managers will be the future users of the dashboard.

The second objective is about the implementation of the dashboard into the organisation. The dashboard must support the Operations management team in making decisions about the
resources of the network on the medium long term. Therefore, the dashboard must become a part of the organisation and a frequently discussed item on the agenda. It must be kept in mind that the performance of the utilization and flexibility of resources is not the final goal of the company. It will probably contribute to a higher profit margin, but increasing this profit margin is the final objective of the company.

Project approach

The project approach to achieve the defined project objectives is based on several approaches:
- the change management approach (John Kotter),
- the problem solving method as a rational process (Faculty of Technique, Policy and Management, Delft University of Technology)
- the sequential design process - Waterfall model (Winston W. Royce).

The change management approach of Kotter is used as a guideline, since the implementation of a dashboard into the organisation imply a change in the way the resource management is dealt with currently and in the future. However, some steps were missing in the approach to fit to the graduation project. For this reason, some connecting steps are identified to define the project approach. These connecting steps originate from the other two methodologies. The project approach is shown in Figure 1-1.

The first phase in the approach is the urgency awareness and goal setting phase, which is performed to clarify the problem and set the project objectives. This phase covers the first three steps of the methodology of Kotter.

The following phase is the conceptualization phase. This phase is going deeply into the organisation DHL Express NL to understand the business and into the methods of performance measurement of utilization and flexibility. Furthermore in the second phase, the findings about the company and the performance measurement at utilization and flexibility are linked in a part about performance measurement at DHL Express NL.

The third phase is about implementation and is present during the conceptualization, design and results phase of the project. This phase is about creating familiarity, a basis of support and mobilising commitment of the Operations management team. Furthermore, the embedding of the dashboard in the organisation is described.

The fourth phase is about the dashboard design and starts with the definitions of the key performance indicators that must be displayed on the dashboard. These indicators are defined during an iterative process of feedback sessions with the stakeholders and the results of the analysis about the needs. Subsequently, the dashboard is constructed based on different data sources about resources and about the operations. Furthermore, a dashboard verification and validation are done. The final part of this phase is about running scenarios, which makes it possible to predict the performance in 1 to 1.5 year.
The fifth phase is the dashboard results phase and presents the current and possible future performance at utilization and flexibility and the consequences of this performance. The final phase includes the conclusions of the whole project and the recommendations.

**Dashboard construction**

Figure 1-2 shows the process from conceptualization to dashboard design. The conceptualization consisted, amongst others, of a system analysis, a process analysis and an exploration of the existing reports, dashboards and scorecards. These activities resulted in a long list of possible key performance indicators. The long list is reduced to a short list of key performance indicators by experts of DHL who selected the most important key performance indicators according to their knowledge and experience.

The literature study, which also took place in the conceptualization phase, resulted in four dimensions of measuring the resource performance: performance categories, processes, resource types and locations. A research is conducted to find the most important aspects of these dimensions. This research led to the first version of key performance indicators.

The first version of key performance indicators is discussed with the Operations management team during feedback sessions. Five of these sessions took place to finally come up with the final key performance indicators, the dashboard and the necessary information (manipulated data set and parameters) to run scenarios. These feedback sessions included discussions about requirements, key performance indicator definitions, names, calculation methods, dashboard layout aspects, scenario parameters and results.
Creating Transparency in Resource Utilization and Flexibility of DHL Express NL

Figure 1-2 Process from conceptualization to dashboard design

Dashboard
The dashboard is constructed in Microsoft Excel, since this software tool is commonly known and available on every computer at DHL Express NL. The dashboard is divided into three parts and each part contains several sheets. The parts and sheets are:

- Data part
- Calculation part
- Overview part

The overview part presents the performance. It consists of a main sheet, a key performance indicator overview sheet, a terminal overview sheet and a sheet about the unnecessary resource costs as a result of idle resources. The main sheet presents the weighted average performance of the Netherlands. The key performance indicator overview is available to view the results of all terminals in the Netherlands for one indicator and the terminal overview sheet shows the performance of all key performance indicators for one location.

The key performance indicators that are presented on the main sheet of the dashboard are divided into four groups: personnel, vehicles and buildings and a system category. The main sheet of the dashboard is shown in Figure 1-3.

For each key performance indicators are norm values defined. These result in green, orange and red values for the values. Green means that the value is in the desired range, orange means that it is almost in the desired range and red means that it is far from the desired range. For the
categories personnel, vehicles and buildings, the weighted average value is displayed. Next to the weighted average value the green zone is indicated and the values of the terminals with the lowest and highest value are displayed on the main sheet as well. The system key performance indicators are the main indicators to express the condition of the whole system. The results of the system key performance indicators show the percentage of terminals in a certain zone (green, orange or red).

**Figure 1-3 Main sheet of the dashboard**

The Key performance indicators that are presented on the dashboard are:

- **Category personnel**
  - Driving hours of total paid hours
  - On tour time of total working time (van tours and truck tours)
  - Extra worked hours versus contract hours
  - Development personnel downsizing flexibility
  - C-license drivers versus C-license vehicles
  - Pieces delivered by non-DHL employees

- **Category Vehicles**
  - Utilization # DHL vehicles (vans and trucks)
  - Volume size (m²) versus total floor space of deployed vehicles
  - Average tours per vehicle
  - Pieces delivered by non-DHL vehicles (van tours and truck tours)

- **Category buildings**
  - Utilization # terminal doors (van tours and truck tours)
  - Utilization terminal floor truck tours Inbound process
  - Utilization sorter (Inbound process and outbound process)

**Embedding**

The embedding process started with familiarity by means of the management conference and conversations with Operations staff managers. It continued with two small surveys about performance measurement at DHL and the added value of a dashboard about the utilization and flexibility of resources in order to create a basis of support. Finally, the draft version of the key performance indicators has been discussed during five feedback sessions with the Operations management team and commitment of the Operations management team was mobilised during these sessions.

At the end, the Managing Director has accepted the role of dashboard owner and he has assigned one of the management team members as being responsible for the maintenance of the dashboard. The Managing Director is a suitable person to be the dashboard owner, since he establishes the management team agenda. He is thus able to monthly put the discussion of the dashboard results on the agenda. At the moment, the Project Manager Equipment is assigned to be the dashboard administrator to maintain the dashboard and to update the dashboard on a monthly basis.

In addition to the designation of a dashboard owner and dashboard administrator, the dashboard file contains a logbook. This logbook is created to register the information about the measures that the Ground Operations managers (the management team members responsible for the operational performance of the network) are going to take. It gives an overview of the agreed actions, the current status and due date for the actions, which must lead to the completion of the actions. The logbook forms the final part of the embedding process.
Conclusions
Two general conclusions that can be drawn based on the two objectives that are defined at the beginning of the project are the following:

1. **The dashboard that is created and the key performance indicators that are displayed on the dashboard match with the requirements of the Operations management team**
   From a quality point of view, the process explained in Figure 1-2 presented the involvement of the Operations management team in order to define the key performance indicators, the dashboard functionality and layout and the design of scenarios. From a business need point of view, the exploration of existing reports, dashboards and scorecards showed that the performance of resource utilization and flexibility is not measured at the moment. This finding endorses the added value of an extra dashboard.

2. **The dashboard is embraced by the management team and is embedded in the organisation**
   Embedding a dashboard into an organisation is not easy. The first element that is needed is commitment of the employees and the insight that the dashboard has an added value in order to make the implementation of an extra dashboard valuable. The first conclusion covers these aspects. In addition, it is necessary that the dashboard will be used in the future. The designation of a dashboard owner and dashboard administrator cover this aspect. Finally, the results of the dashboard must lead to actions. The logbook function of the dashboard should cover the final aspect of embedding.

Furthermore, some specific conclusions can be drawn from the project. The most important conclusions are listed below.

3. **Unambiguous definitions of utilization and flexibility and the names of the key performance indicators are of great importance for the value of the dashboard.**
   The feedback sessions with the Operations management team demonstrated the importance of unambiguous definitions of the terms utilization and flexibility and the key performance indicator names. Different interpretations of the words utilization and flexibility and the key performance indicators by the management team can easily lead to miscommunication.

4. **Familiarity, support and commitment have led to the embedding of the dashboard into the organisation**
   The activities of creating familiarity, support and commitment appeared to be very important to the real embedding of the dashboard. The acceptance of the content of the dashboard and the dashboard owner role and dashboard administrator role, led to the real embedding of the dashboard.

Recommendations
The conclusions that are drawn showed that both objectives are achieved. However, some point of attention are written down as recommendations. These recommendations are divided into two types of recommendations: for the dashboard and for DHL Express NL. The main recommendations for DHL Express NL are listed below.

1. **Remain aware of the relation between the utilization of resources on the one hand and the productivity and service performance on the other hand**
   It is already stated in the introduction that optimising the resource utilization and flexibility is not the final objective of the company. The dashboard must raise the right questions in order to find the problems in the company that cause the opposing forces for the final goal: profit maximisation. Furthermore, optimising the resource utilization may
probably also contradict with the service level performance. The position of resource utilization must be clear to use the dashboard properly.

2. **Remain critical on the key performance indicators' composition, definitions and norm values**
   One of the conclusions stated that clarity about the definitions of the terms utilization and flexibility and of the key performance indicators are of great importance for the value of the dashboard. A recommendation that may be added is that the composition, definitions and norm values of the key performance indicators must be judged frequently in order to determine if they are still relevant to measure, monitor and manage.

3. **Keep the logbook up to date**
   One of the conclusions endorses the importance of the logbook function as the final step of the embedding process. The recommendation to DHL Express NL therefore is to keep this logbook up to date and benefit from this function in order to manage the resource utilization and flexibility.

4. **Mobilise commitment of the Sales department to the dashboard results**
   The underlying factors of the profit margin are explained in the introduction. The utilization of resources mainly depends on the amount of volume that is offered by the customers. The responsible department for acquiring volume is the Sales department. A better cooperation between Sales and Operations makes it possible to align the volume acquisition and the operational capacity.
Phase 1 - Urgency awareness and goal achievement

The project approach is explained in the second chapter. However, the first phase of the approach is urgency awareness and goal achievement. The phase consists of two chapters: the first chapter that introduces the project and the second chapter that goes into more depth about the objectives, approach and preconditions of the project.
Creating Transparency in Resource Utilization and Flexibility of DHL Express NL
1 Introduction

DHL is a large player in the international express industry. According to the Cambridge Advanced Learner’s Dictionary the word ‘express’ means “a service which does something faster than usual”. (Cambridge Online Dictionary, 2010) At the moment, the global market is dominated by four express providers, also known as (global) integrators or global logistics providers. (DHL Express NL, 2010) DHL Express is one of them. The company transport goods from an origin to a destination location. This process is executed by means of a network and resources, like employees, vehicles and buildings.

The amount of goods shipped by the Express industry has decreased the past years. For DHL Express NL the amount of shipments has decreased from 2007 to 2010 by 16%. (DHL Express NL, 2010) The decrease in pieces is harmful for the revenue of DHL Express NL. Especially when the resources are not fully utilized at the same time, since this contributes to a lower profit margin.

At the moment, transparency in the performance of resource utilization is lacking. This lack of insight makes it difficult to take the right management decisions about resource management. The performance of resource utilization is monitored ad hoc in case of problems, but a structural way of monitoring is missing.

The goal of this project is to make the performance on resource utilization transparent. The Operations management team has asked to create a dashboard which displays the performance to create structural transparency. The managers are not only interested in the performance of the current situation, but also at a tactical level, which is defined as a time period of 1 to 1.5 years. Furthermore, the managers aim to use the dashboard as a support tool for management decisions.

Next to the interest in utilization, the managers are interested in the flexibility of the resources. The volume difference between 2007 and 2010 is significant. DHL Express NL would like to be able to respond on the differences in volume, since it contributes to a higher profit margin, which is important for the market position of DHL Express. However, the project does not take into account the profit margin, since it is focused on the Operations department of DHL Express NL and thus focuses on the resources usage only. Besides this project, several projects are carried out with the aim to improve the profit margin.

Research methods that are used to achieve the goals as explained above are a literature study, conversations and small surveys with DHL Operations staff managers, a system analysis, a process analysis, a research within DHL and feedback sessions with the Operations management team took place. These activities are performed to gather data about the problem, the background and the solutions, but it is also used to embed the dashboard into the organisation.

DHL Express offers three services. However, the project concerns only the Day Definite service for three reasons: the process of this service is more complicated, the process is executed with more types of resources than the other services. The Day Definite service is also financially more interesting, since the profit margins are this service are the lowest at the moment.

Chapter 2 in this report describes a rough problem analysis and the project design that must finally lead to the achievement of the two goals. The rest of the report is structured based on the methodology phases that are identified in Chapter 2. Chapter 3 and 4 form the conceptualization part. Chapter 3 gives a short overview of the company DHL Express NL and provide the necessary information to understand the business. The fourth chapter is about performance measurement in general and performance measurement applied for DHL Express NL. The fifth chapter is about performance measurement at DHL.
The next part of the report is Implementation and consists of two chapters. Chapter 6 is about creating familiarity, acceptance, and commitment in a company, which must lead to the embedding of the dashboard. The embedding is described in Chapter 7.

Chapter 8 to 11 are about the dashboard. Chapter 8 is about the process that is went through to define the key performance indicators and build the dashboard. The structure and functionality of the dashboard are explained in Chapter 9, followed by the verification and validation of the dashboard in Chapter 10. Chapter 11 explains how the performance in the future can be predicted by running scenarios.

The dashboard results of the current situation and the scenarios are described in respectively Chapter 12 and 13. The report ends with an evaluation that consists of conclusions (Chapter 14) and recommendations (Chapter 14).
2 Problem analysis and project design

The previous chapter introduced the problem and the project objectives and approach. This chapter goes into more depth about these topics. The chapter starts with a rough problem analysis and the relevance of the project. (section 2.1) The problems and relevance lead to the main project objectives. The project methodology that contributes to the goal achievement is then described. The methodology has been guidance for the report structure, which is explained in the following section. The project is done with some limiting conditions. Those boundaries are explained in the fifth section. Finally, the stakeholders of the project are discussed. The chapter ends with a conclusions.

2.1 Rough problem analysis and relevance

The graduation project started with a problem description by the Managing Director Operations and the Operations Programs Manager in May 2010. The scheme of Figure 2-1 was used by them to explain the problem. A short explanation is given below.

DHL Express transports volume (like parcels and pallets). These pieces go through a process (the process of shipping pieces from an origin location to a destination location). This process is performed by employees, supported by buildings, equipment & vehicles and is organised by means of a network. The availability of the resources, the productivity targets and the service requirements in combination with the amount of incoming volume determine to what extent the resources and network are utilized. This utilization influences the operational costs and the costs structure of DHL influence the operational utilization as well. DHL Express NL assumes that the operational utilization is too low compared to the desired situation. Furthermore DHL Express NL assumes that the insufficient capacity utilization contributes to a lower profit margin. These assumptions form the start of the project.

Therefore, the problem explanation is formulated into the following initial question:

How can DHL influence the transported volume, the network capacity and the processes within the DHL Express NL system, on the basis of the system’s capacity utilization, in order to improve the profit margin?

A rough problem analysis is performed, in order to find out the underlying problems and to formulate project objectives.
2.1.1 Underlying problems of a decreased profit margin
The three main aspects that determine the profit margin are the costs on the one hand and the tariffs and the amount of volume on the other hand. Figure 2-2 shows them all three, since the tariff is visualised by the slope of the revenue line. The profit margin is determined by these three components.

The profit margin on the domestic market in The Netherlands is under pressure. The figure shows the costs structure of DHL Express. It can be concluded that the fixed costs are relatively high. This is because DHL Express must own almost the whole infrastructure network in order to offer the customers the high service that is promised. The variable costs part is relatively small and mainly consists of the hiring of employees and vehicles.

Decreased amount of volume
The amount of volume decreased the past few years. As already mentioned in the introduction, the amount of shipment decreased from 2007 to 2010. This decrease in volume is mainly caused by the economic recession, which affected the amount of goods that must be shipped. This dropdown in volume have two consequences: first, it causes a decrease in revenue and second, it initiates low tariffs, as explained in the section about competitive tariffs.

Competitive tariffs
In the past few years, new entrants entered the market with a totally different strategy: low costs and a standard operation process. These low cost Express providers offer lower tariffs, but also less service. For example, they only ship parcels, instead of pallets, parcels and other kind of goods. Companies that operate as low costs Express providers are GLS and DPD. DHL Express has another strategy: it offers a wide range of services to the customer; in types of services as well as in types of goods that may be transported. However, the seam side of this service performance is the enormous infrastructural network that is required to offer these services and quality. The entrance of new market players made the market very competitive and dropped the tariffs as well. This affected the DHL business, since DHL cannot offer the same tariffs as the low cost providers because of the extensive fixed costs.

Delft University of Technology and DHL Express NL
Another reason for the decreased tariffs is the recession. The recession dropped down the amount of volume that the customer would like to ship, as explained above. The drop in volume size creates overcapacity on the market, since the supply is bigger than the demand. This overcapacity results also in a decrease of the tariffs.

**Decreased amount of costs**

The lower tariffs and lower amount of volume must be absorbed by lower costs in order to keep the business profitable. Keeping the costs low is difficult because of the high fixed costs. Part of the total costs can be saved, because of the flexible part of the cost structure. However, the majority cannot be cut off immediately, since these costs are caused by buildings, vehicles and employees and must be paid on a monthly or yearly basis.

At the moment, the revenue is decreasing because of the lower tariffs and lower volumes. Therefore, the profitability is at risk. If the amount of volume becomes lower than amount \( V \) of Figure 2-2, the volume in the network is not enough to cover the fixed costs that guarantee the service level. A company as DHL is able to handle this situation for a certain time period, but definitely not on the long term.

**2.1.2 Relevance**

The underlying problems of a decreased profit margin are explained in section 2.1.1: a lower amount of volume, lower tariffs and high fixed costs in order to guarantee the service level that is offered by DHL Express. At the moment, the volumes are relatively low and the fill rate is probably at risk.

DHL Express NL has to take a decision at a strategic level in order to keep the business profitable. Either the volume must increase or the infrastructure (buildings, vehicles and employees) must be brought back to a certain size if the volume will be lower than the amount \( X \).

The project is initiated by the Operations department of DHL Express NL, which means that the utilization of the networks' resources is the main object of interest for this project.

In order to decide whether the infrastructure is too large or not, it is important to know the current situation of the resources' utilization of the network, but also the future situation of the resource utilization. Furthermore, it is interesting to know the flexible part of the resources that are used. In general, it is always preferable to have a flexible part, which is able to absorb the volume changes. In the current situation, the numbers about resource utilization and flexibility are calculated on an ad hoc basis, but structural transparency in the resource utilization and flexibility is lacking.

In addition, the importance to measure the utilization of capacity is also confirmed in literature. According to James F. Ragan, measuring capacity utilization is important, since it plays a major role in evaluating economic activity, for example to explain the behaviour of investment, inflation, productivity, profits and output. Furthermore, it can support businessmen and economists in assessing economic conditions and forecasting future activities. (Ragan, 1976)

The statements of Ragan, exactly fits into the business need of DHL Express that is described above.

**2.2 Project objectives**

Section 2.1 showed the initial question of DHL Express NL and it explained the underlying problems. The rough problem analysis has been used to convert the initial question into two interesting project objectives.

3. Create transparency about the resource utilization and flexibility at DHL Express NL by means of a dashboard
4. Embed the dashboard into the Operations department to support the managers on medium long term decisions

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The first objective is about displaying the resource utilization and flexibility, for the current situation as well as for the possible future situations. It is important that this dashboard is corresponding with the preferences and requirements of the Operations management team, which is the group of managers that will use the dashboard in the future. The second objective is about the implementation of the dashboard into the organisation. The dashboard must support the Operations management team to take decisions about the resources of the network on the medium long term. Therefore, the dashboard must become a part of the organisation and a frequently discussed item on the agenda.

The dashboard makes the performance on resource utilization and flexibility visible and the embedding of the dashboard must lead to the situation that the managers are able to take thought-out decisions in order to get the resource utilization and flexibility at a desired level. However, it must be kept in mind that the resource utilization and flexibility are not the final goal of the company and optimisation is thus not the goal of this project. Maximising the profit margin is the final goal of DHL and this one must be optimised. Nevertheless, resource utilization in a desired range would contribute to the profit margin maximisation and resource flexibility makes it possible to respond on volume changes. The terms dashboard, utilization and flexibility are explained in Chapter 4 into more detail.

2.3 Methodology

The formulated objectives may be achieved by following a certain approach. This section explains three tried and tested methods that have ground in common with the project issues as explained earlier in this chapter and results in a project approach. These methods are the change management methodology of John Kotter, the problem solving method of the Faculty of Technology, Policy and Management of the Delft University of Technology and the Waterfall method, originally from Winston W. Ryce. The latter is useful for sequential design processes. These methods are shortly discussed to show the usability of the methods and to judge which one is the most convenient one for this project.

2.3.1 Change management

The 8 steps for change management of John Kotter are used for project management and provide the company a process to implement an organisational change. The 8 steps of Kotter are (Kotter International, 2010):

1. Acting With Urgency
2. Developing the Guiding Coalition
3. Developing a Change Vision
4. Communicating the Vision Buy-in
5. Empowering Broad-based Action
6. Generating Short-term Wins
7. Don’t Let Up
8. Make Change Stick

Changes are inevitable within an organisation on the way of success. According to the website of John Kotter, “a company can increase its chance of success, by improving their ability to change.” (Kotter International, 2010)

This methodology fits to the project because the usage of a dashboard about the utilization and flexibility of resources is something new in the company. The dashboard must fit into the organisation, the future users must see the added value of the dashboard and the results must be accurate in order to make the dashboard useful. Embedding the dashboard into the organisation is of crucial importance to make the tool useful now and in the future.
Deutsche Post World Net (DPWN), which is the group where DHL Express belongs to, does have a programme for change management called ACT (Accelerating Change & Transition). According to DPWN, change management is "the development and implementation of strategies to deal with the impact on people of changes to operations, processes and systems/technology, thereby accelerating the successful implementation of change." (Deutsche Post World Net)

The ACT method consists of 9 phases. These phases and activities are more or less similar to the 8-step-method of Kotter, as described above. The 9 steps of DPWN's change management are:

1. Planning and executing the change
2. Leading the change
3. Creating a shared need
4. Develop a vision
5. Mobilise commitment
6. Communicating the change
7. Aligning the infrastructure
8. Sustaining momentum
9. Creating a change plan

The steps include the same activities as the change management method of Kotter, but the activities are grouped in another way and the order is a little different.

2.3.2 Problem solving as a rational process

The Faculty of Technology, Policy and Management of the Delft University of Technology uses a problem solving method based on the decision-making process model of Herbert Simon. (Bots, 2003) This method consists of the following 6 steps:

1. Conceptualization
2. Specification
3. Search for solutions
4. Choice
5. Implementation
6. Evaluation

This method originates from the thought of problem solving as a rational process. Rationality implies that there is a connection between the goal that a stakeholder would like to achieve and the way this stakeholder is acting.

This methodology fits to the project because of the problem solving aspect. The phases of this methodology are not as specific as the change methodology phases, but it supports the process by giving more structure to the process. Compared to the change management methodology, it adds values especially in the first phases of the method: the conceptualization phase and the specification phase.

2.3.3 Sequential design process

The third methodology that has ground in common with the project is the Waterfall method of Winston W. Royce, which is used in software development processes. There are several modified versions of this method as well. One of these versions is:

1. Conception
2. Initiation
3. Analysis
4. Design
5. Construction
6. Testing
7. Maintenance

The model is a sequential design process which implies that one phase must be completed before the next one is started. The model originates from the manufacturing and construction industries and is founded by the time the field of software development was a not-yet-existing
industry. However, the manufacturing and constructing industries have at least one similarity with the software development industry, since modifications after construction are not desirable or even not possible. That is the reason why this method is used in the software development industry nowadays. (Museum of Learning, 2010)

The waterfall methodology fits to the project because of the design process approach. This project is a design project, rather than a research project. For this reason, it is important to use the design perspective as well. Especially the design phase and the maintenance phase are of value for the project.

2.3.4 Project methodology

The methodology that is used for this project is a combination of these three methodologies. In fact, the majority of the ideas of Kotter are used, combined with some steps of the problem solving and sequential design process methods. The methodology that is used is as follows:

1. Urgency awareness and goal achievement
2. Conceptualization
3. Implementation
4. Dashboard design
5. Results
6. Evaluation

Introducing a dashboard in an organisation requires changes in this organisation as explained above. This is the reason why the change management model is used as guidance. However, some steps were missing in this method to totally fit to this graduation project. For this reason, some connecting phases, originating from the other two mentioned methodologies, are added to the methodology. Furthermore, some steps are combined, since they already resulted from the project aim and set-up.

The urgency awareness and goal achievement phase is the first phase and includes the clarification of the problem and the design of the project: what objectives must be achieved at the end of the project? This phase covers the first three phases of the Kotter methodology.

The second phase is the conceptualization phase, originating from the first step of the problem solving method as well as the design method. The conceptualization phase mainly covers necessary background information about the company DHL and about the terms utilization, flexibility and performance measurement. It can also be called the analysis part of the project.

The third phase is the implementation phase and encloses information about how the employees of DHL were committed to creating the dashboard and using the dashboard in the future and about how the dashboard was embedded in the organisation. This phase covers the fourth and fifth phase of Kotter and the fifth step of the problem solving method. The implementation phase halfway a methodology seems unusual at first side, but the information of the implementation phase is necessary to understand the creation of the dashboard, which is explained in the next phase.

The fourth phase is thus the dashboard design phase and mainly originates from the fourth step of the design process method. The dashboard design phase includes information about the data that is displayed on the dashboard, the dashboard building for analysing the current and future performance and the verification and validation of the dashboard.

The fifth phase is the results phase. This phase mainly covers the sixth phase of the Kotter approach and shows the results of the current situation and possible future situations by means of a dashboard.

The final phase is the evaluation phase and mainly covers the sixth phase of the problem solving method and the design process method. In the final phase conclusions are drawn and recommendations are made about the whole project.
2.4 Report structure

The report is divided into six parts; the six phases explained in the previous section. Every phase is divided into different chapters, which are based on the sub objectives. The report structure is presented in Figure 2-3. The content of the chapters is already presented in the introduction and is showed in the tables of content as well, so it is not explained any further in this section. All phases except the implementation phase occur more or less sequential. The implementation phase is occurring parallel to the conceptualization, design and results phase.

![Figure 2-3 Report structure: chapter overview](image)

2.5 Scope

The project is limited by several boundaries, as the project must be executed within a certain time period. This section explains the five main aspects with respect to limitations.

2.5.1 Service boundary

The first boundary is a service boundary. DHL offers three services to the customers: a Same Day (SD) service, a Time Definite (TD) service and a Day Definite (DD) service. The Same Day service is out of scope, since this service is processed totally separated from the Time Definite and Day Definite service.

Time Definite and Day Definite service

The processes of the TD and DD service were more and more interwoven during the past years. Nevertheless, the two services became two separated business units from an organisational point of view, since September 2010. One of the reasons to split the DD and TD service is the intransparency about the revenues and costs of each service. Since January 2010, the operations of both services are completely split. The DD service is “for international door-to-door delivery within a certain number of days for less urgent and heavier shipments”. (DHL Express NL, 2010a) The TD service is “for international door-to-door delivery by a specific time or by the end of the next possible business day”. (DHL Express NL, 2010)

Focus on the Day Definite service

The project focuses on the DD service for several reasons. The first reason is that the DD service is more interesting from a resource point of view. The TD service mainly handles documents, and thus requires hardly space in buildings and vehicles. Furthermore, the process is handled manually, which means that there is no equipment required. The DD service mainly handles parcels and pallets, which require more space in buildings and vehicles and require equipment like a sorter and forklifts to sort the goods. The second reason is that the DD service is more interesting from a process point of view. The network of the TD service is simpler within The Netherlands, since the picked up shipments all go...
to one location. The DD service process is much more complex, which makes it more interesting
to focus on this process. A more detailed process description is presented in Chapter 3.
Finally, the DD service is more interesting from a financial point of view. The DD service requires
more investment, since it uses more equipment. Furthermore, this service has a lower profit
margin compared to the TD service, since customers pay a higher tariff to ship a shipment by the
TD service. The DD service therefore has the highest challenge from an economical point of view.

2.5.2 Geographical boundary
The second boundary is the geographical boundary. The previous section already mentioned "The
Netherlands" and DHL Express NL is also mentioned earlier in this chapter. The focus of this
project is The Netherlands.
This means that all 14 DD terminals of The Netherlands are taken into account. These terminals
are located in Alkmaar, Amersfoort, Amsterdam, Arnhem, Den Bosch, Den Haag, Drachten,
Eindhoven, Hengelo, Maastricht, Roosendaal, Rotterdam, Utrecht and Zwolle. The terminals are
further discussed in Chapter 3.

2.5.3 Process boundary
A precise description of the boundary with respect to processes is difficult to give at this moment.
Chapter 3 explains more about the processes at DHL Express NL. However, the following can be
stated already.
The DD service actually consists of two sub services: a domestic service (DDD) and an
international service (DDI). The processes of those two services are interwoven. From a process
point of view, only the processes that take place in The Netherlands are taken into account. This
means that the processes of the domestic service are totally taken into account and that the
processes of an International shipment are not completely included, but only the part that takes
place on Dutch territory.

2.5.4 Business level boundary
In general, there can be identified three management business levels: strategic level, tactical level
and an operational level.
Section 2.2 stated that the Operations managers of DHL Express NL are looking for support for
their medium long term decisions. This means that the focus of the project is on a tactical
business level, since the strategic level focuses on the long term policy and the operational level
focus on the operations on a daily basis. The term 'medium long term' is vague and must be
specified any further. The Operations management team, which is the initiator of the project, has
set this term on 1 to 1.5 years.
This means that the dashboard and recommendations must be aligned with the time period. As
clarified earlier, the Operations management team is interested in the current performance at
utilization and flexibility of resources, but also in the future performance. This means that the
future situation is now defined as the situation in about 1 or 1.5 years.

2.6 Stakeholders
The identification of the stakeholders is also a part of the change management methodology of
Kotter. This section identifies a group of employees that played a crucial role during the project;
these are called the stakeholders. Of course, there are many other involved employees that could
be assigned as stakeholders, but the group mentioned here are the most important persons.
As explained in the introduction of this chapter, the project was introduced by the Managing
Director Operations and the Operations Programs Manager in May 2010. In the meantime, the
organisational structure is changed. In the new structure, the employees that are involved in the
project are the participants of the Operations management team. The members of this team are
the stakeholders of the problem, since they must use the dashboard in the future in order to get
supported for decisions on the medium long term.
2.7 Conclusions problem analysis and problem design

The problem focused on in this project is the lack of structural transparency in the resource utilization and flexibility of DHL Express NL. This structural way of monitoring the transparency of resource utilization and flexibility is desired by the management team of DHL Express Operations. A good performance on this aspect contributes to a higher profit margin, which is the main objective of the company. Therefore the Operations management team would like to have a dashboard, which structurally monitors the transparency and supports them in management decisions on the medium long term.

Two project objectives are formulated in order to monitor the transparency:

1. Create transparency about the resource utilization and flexibility at DHL Express NL by means of a dashboard
2. Embed the dashboard into the Operations department to support the managers on medium long term decisions

A six phase approach is chosen to achieve these objectives. The approach is derived from three tried and tested methodologies: the change management methodology of Kotter, the methodology about problem solving as a rational process of the faculty of Technology, Policy and Management and the sequential design process of Winston W. Royce. These phases are the urgency awareness and goal achievement, conceptualization, implementation, dashboard design, results and finally evaluation. Boundaries with respect to geographical area, service, processes and business level are defined, in order to deal with the limited time available.
Phase 2 - Conceptualization

The second phase is the conceptualization phase. The conceptualization phase is the preparation for the dashboard design phase. In this phase, the necessary background about the company DHL Express is described and research is conducted to the phenomenon performance measurement (especially capacity utilization and flexibility). Furthermore, the information from literature and the company information are joined in a chapter about performance measurement at DHL Express.
3 Company overview DHL Express NL

The previous chapters elaborated on the problem, project objectives, approach and scope. This chapter provides necessary background information about the company DHL Express NL to understand the business.

As an Express provider, DHL Express ships shipments from the sender to the receiver. On paper this sounds easy, but the actual situation is different. The following sections explain which complexity is present in this seemingly simple business. The chapter starts with some facts and figures of the company Deutsche Post DHL, the division DHL Express and the region DHL Express NL. After this introduction, the chapter continues with a description of the company.

For this description, the OSI model (ISO Reference Model for Open Systems Interconnection) of the International Organisation of Standardization (ISO) has been an inspiration to structure the company information in different layers. (Walrand, 1991) The model is explained in Appendix A. The layers that are identified for the company DHL Express are visualised in Figure 3-1.

![Figure 3-1 Different layers of the company DHL Express NL](image)

The company is described by explaining the Day Definite (DD) service first, followed by the type of shipments and type of units that are transported by the DD service. Furthermore, the transportation processes are clarified in more detail. Then the network is explained, which actually represent in what structures the shipments are transported from the sender to the receiver. Finally, the physical resources are explained, which consist of buildings, vehicles and employees. The layer model for DHL Express NL is further explained in Appendix A.

3.1 Facts and figures DHL

The first section presents some facts and figures about DHL. It starts with the company Deutsche Post DHL, whereof DHL is part. It continues with DHL Express, which is one of the divisions of DHL. The section ends with DHL Express NL, which is a region of DHL Express.
**Deutsche Post DHL**

DHL Express is part of the group Deutsche Post DHL. Deutsche Post is the postal service in Germany, while DHL is one of the main four global logistics service providers, as explained before. Together, the group forms the world’s leading postal and logistics services group. Some facts about Deutsche Post DHL: the group has generated revenue in 2009 of 46 billion Euros, around 500,000 employees worldwide and offers services in more than 220 countries and territories. (Deutsche Post DHL, 2010a)

The organisational structure of Deutsche Post DHL is shown in Figure 3-2. As can be derived from the figure, DHL consists of four divisions: Mail, Express, Global Forwarding Freight and Supply chain. The project only focuses on one of the divisions: Express. This division is explained into further detail in the next section and the facts and figures are presented in the next sub section.

---

**DHL Express**

DHL Express is one of the four global market players on the Express market. Several synonyms are used to indicate this market. For example, the Courier, Express and Parcel (CEP) market, the

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Delft University of Technology and DHL Express NL
Express market and the global logistics industry. The fact that DHL is the largest Express provider in Europe, Asia, the Pacific and the Middle East/Africa, endorses that DHL certainly is one of the main market players. (DHL Express NL, 2010k)

DHL Express consists of two former companies: DHL and Van Gend en Loos Euro Express. The company DHL is founded in the USA in 1969 and named after the three founders Adrian Dalsey, Larry Hillblom and Robert Lynn. They started with personally shipping papers from San Francisco to Honolulu by airplane and the company gradually grew from this start-up company into the market leader in the express industry. (DHL Express NL, 2010) In 1999, Deutsche Post acquired a 25% and in 2002, Deutsche Post World Net (DPWN) acquired a majority share of this company. (Deutsche Post DHL, 2010b)

Van Gend en Loos is founded by merging two diligence companies in 1809. In the past decades, Van Gend en Loos is taken over by several companies, amongst others the Dutch Railway company (NS) and the shipping company Nedlloyd. (Wikipedia, 2010) DPWN combined the former brands DHL, Van Gend en Loos Euro Express and Danzas into the brand DHL for the parcel and logistics business. (Deutsche Post DHL, 2010b) The table below shows some facts as matters stood in 2009, in order to give a quick impression of DHL Express: (DHL Express NL, 2010h)

<table>
<thead>
<tr>
<th>Table 3-1 facts and figures 2009 of DHL Express worldwide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head Office</td>
</tr>
<tr>
<td>Revenue</td>
</tr>
<tr>
<td>Shipments</td>
</tr>
<tr>
<td>Network</td>
</tr>
<tr>
<td>Employees</td>
</tr>
<tr>
<td>Customers</td>
</tr>
<tr>
<td>Vehicles</td>
</tr>
<tr>
<td>Facilities</td>
</tr>
</tbody>
</table>

DHL Express NL
DHL Express NL is one of the regions within DHL Express. DHL Express NL has seven business units: Operations, Finance & Control, Marketing & Sales, Strategy & Business Development, HRM, Business IT and Selectvracht. The project is performed for the Operations department, as clarified before.

As explained in Chapter 2, Operations consists of two parts since September 2010: the Time Definite organisation and the Day Definite organisation. Since the project focuses on the Day Definite service, only the organisational chart of this organisation is showed in Figure 3-3. Table 3-2 (DHL Express NL, 2010o) shows some facts and figures as matter stood in December 2010.

<table>
<thead>
<tr>
<th>Table 3-2 Facts and figures of DHL Express NL Day Definite</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customers</td>
</tr>
<tr>
<td>Network</td>
</tr>
<tr>
<td>Shipments (yearly)</td>
</tr>
<tr>
<td>Drivers</td>
</tr>
<tr>
<td>Vehicles</td>
</tr>
<tr>
<td>Facilities</td>
</tr>
</tbody>
</table>
Creating Transparency in Resource Utilization and Flexibility of DHL Express NL

Figure 3-3 (DHL Express NL, 2010) shows that there are two levels of management within the Operations DD organisation: an upper and a lower level. The upper level is solely one person and is formed by the Managing Director Operations Day Definite. The lower level consists of seven persons, two functions of which are primarily working for another department. The management team, consisting of the Managing Director, the OPS Programs Manager, the OPM COG&QCC, the OPS Support Manager and the two Ground Operations Managers, have played an important role and are mentioned frequently in the report. The OPS Programs manager is responsible for the improvement of the core business processes; the OPM COG&QCC (Customer Operations Group & Quality and Control Centre) is responsible for the relation between the customer and the Operations department and for network monitoring: the OPS support manager is responsible for all support activities of the core business processes, like vehicles; the Ground OPS managers are responsible for the total operational process.

3.2 The Day Definite Domestic and International service

The project focuses on the Day Definite service. It consists of two sub services: the domestic and the international service. Both are explained into more detail below. These services consist of one or more products. A product is a package of conditions that determine when the shipment is delivered and how fast the shipment is delivered. These products are explained as well.

The Day Definite service mainly is a business to business industry instead of a business to consumer market. Furthermore, the service is characterised as a process with a coarse pickup network and an intricate delivery network: the pickups mainly consist of many shipments per sender which must be delivered at many receivers.

3.2.1 Day Definite Domestic service (DDD)

"For domestic door-to-door deliveries within a certain number of days for less urgent and heavier shipments, choose our cost-effective Day Definite services. Get the reliability of a DHL Express delivery on a certain day with end-to-end tracking." (DHL Express NL, 2010a)

As the quotation above states: the Day Definite service is about cost efficiency and speed is of minor importance. Furthermore, it is especially used for shipments that are reasonable urgent. The service has a dense network, which means that shipments can be picked up and delivered at most locations. The domestic service consists of a few products, including the DHL Europlus product and the Expresser product.
The whole process starts with a booking. If the booking concerns a Europlus product, a driver picks up the shipment(s) the next working day. Delivery of the shipments occurs the subsequent working day.

If the booking concerns an Expresser product and is booked before 15:00hr, the shipment(s) is/are picked up the same working day and delivery takes place the next working day before 11:00hr. In case the booking is done after 15:00hr, the pickup of the shipment(s) is/are done the next working day and delivery occurs the subsequent working day before 11:00hr. (DHL Express NL, 2010k)

The restrictions that apply to the Europlus and Expresser products are described in Appendix B.

3.2.2 Day Definite International (DDI)

“For international door-to-door delivery within a certain number of days for less urgent and heavier shipments, choose DHL’s cost-effective Day Definite services. Get the reliability of an express delivery on a certain day with end-to-end tracking and customs clearance for dutiable goods.” (DHL Express NL, 2010a)

This service consists of two products, namely the DHL Europlus and the DHL Economy Select. The DHL Europlus is especially for shipments within the Benelux and is delivered the next working day before closure of the business hours. This product is already explained at the previous section, since shipments to the Benelux or within The Netherlands are performed in the same way.

The DHL Economy Select product delivers the shipment within a guaranteed number of days and is served in more than 25 European countries. (DHL Express NL, 2010m) The transit time depends on the destination country and varies between the one and seven working days. For example: shipping a shipment from The Netherlands to Norway takes 4 days, while shipping a shipment from The Netherlands to Russia takes 7 working days. The transit time can be calculated by using the Transit Time Calculator Tool (TTTC). The restrictions that apply to the Economy Select product are described in Appendix B.

3.3 Shipments and pieces

The previous section described the service and different products. This section is about the unit of a product: a shipment. A shipment can be an Expresser, a Europlus or an Economy Select product. However, a shipment is not the smallest unit handled at DHL Express, since a shipment contains one or more pieces. A piece is thus the smallest unit. This section is about the different appearance types of pieces.

DHL Express ships many appearance types of goods. These can roughly be divided into four categories:

- Documents
- Parcels (also: conveyables),
- Pallets
- Non-conveyables (also: NCYs)

Documents are left out of scope for this project, since the amount of documents that must be delivered by the Day Definite service is approximately [number]. (DHL Express NL, 2010b)

Parcels are goods that can be sorted by the sorter. The majority of the delivery goods are parcels, around [number]. (DHL Express NL, 2010b) Since these goods can be handled automatically, it saves time for the sorting process. The parcels are in scope of the products, since the form the majority of the pieces and they are handled with equipment, which is interesting from a resource utilization point of view.
Non-conveyables are goods that cannot be sorted automatically and must be sorted manually, possibly supported by a forklift. This takes more time for the sorting process, as well as for the pickup and delivery process. For the delivery process, the share of non-conveyables is around 23% of the total volume. The non-conveyables are also in scope, since these pieces require relatively much terminal space and must be handled by equipment as well.

A pallet is a wooden plateau with goods on it. The size of a pallet may vary. The pallets must be sorted manually as well and moved with a forklift. This type of pieces is also in scope for the same reasons as the non-conveyables.

More details about the different type of goods, like restrictions and size, as well as a picture per category can be found in Appendix B.

### 3.4 Processes that provide transportation

The pieces of a shipment are shipped from sender to receiver. This means that the shipments must be transported between the origin and destination location. The transportation is done during processes. This section explains which processes takes place to be able to transport the pieces from sender to receiver.

The transportation processes are explained by using the Day Definite Domestic process; this process is the easiest process and the majority of the Day Definite shipments are domestic shipments. Around the **55%** of the picked up shipments had an international destination and around the **45%** of the delivered shipments originated from foreign countries in 2010. (DHL Express NL, 2011) Figure 3-4 presents the succession of processes of the DDD process. From this picture, three ways of transportation can be considered: the pickup, the domestic line haul and the local delivery. These activities are discussed one by one in this section.

![Figure 3-4 Day Definite Domestic process and sub processes](image)

The DDI process includes the same processes, but some extra steps are added. However, the extra processes are out of scope, since the project focuses on the processes taking place in The Netherlands. In order to be complete, the full DDI process is explained in Appendix C.

A detailed process analysis is performed in order to identify the possible indicators that reflect the processes' performance. This process analysis is explained in Chapter 5. Hereafter, the pickup, line haul and delivery process are roughly explained. Furthermore, the way they are related together is also clarified.

#### Pickup process

The preparation of the pickup process starts when a booking is registered and processed in the system, the shipment is assigned to a terminal and to a driver. The area around a terminal is divided into several territories. Each driver is assigned to one of these territories and is
responsible for the pickup of the shipments in this area. The length of a working day is pursued to be 9 hours. After the working day, the driver is driving back to the terminal and unloads the vehicle. The pieces are ready for further processing by then. The pickup process normally takes place in the afternoon and includes shipments from the DDD services as well as from the DDI service.

**Line haul process**
At the pickup terminal, the pieces are sorted for distribution to the right delivery terminal. The movement from the pickup terminal to the delivery terminal is done by domestic line hauls. A domestic line haul is a tour of a large truck. For DDD shipments, this truck contains pieces from one terminal to one or more other terminals. For DDI shipments, this truck contains shipments for all foreign destinations, since the pieces are sorted at a later moment in time. The network belonging to those tours is explained in the next section. DHL Express has 185 trucks and tractors available to provide these tours. This kind of transportation is done during the late evening and night.

**Delivery process**
The delivery process is the final step in the whole process: the delivery process leads to the delivery of the shipment(s) to the receiver. All shipments that arrived at the delivery terminal are sorted. Again, the area around the terminal is divided into several territories. Each territory is assigned to a driver. The driver is provided with a list of all shipments that must be delivered to the customers.

A driver with a small vehicle is able to deliver shipments at nine customers in one hour and a driver with a large vehicle may deliver shipments at two or three customers in one hour. (DHL Express NL, 2010g) The delivery takes place during the morning and partly during the afternoon and includes DDD and DDI shipments. One must keep in mind that the DDI shipments that must be delivered are not equal to the DDI shipments that are picked up in the Netherlands: the pickup DDI shipments have their destination outside The Netherlands; the delivery DDI shipments have their origin in The Netherlands.

**The integrated process**
In fact, the processes mentioned above do not take place completely separated. The transportation processes as well as the processes that take place at the terminals form a 24-hour cycle which means that this is an ongoing process. The pickup and delivery processes are explained separately above, but both processes are interwoven. In general, deliveries occur in the morning and in the early afternoon, while the pickups occur in the afternoon, but the processes are performed by one driver during one working day. This process is called the pickup and delivery process, or PuD process.

This paragraph explains a cycle of 24 hours and starts with the beginning of the working day of the drivers in the morning. The drivers start their tour from the terminal with a vehicle filled with shipments. They deliver the shipments one by one in the morning and in the early afternoon. In between, a few early pickups are done already too. During the afternoon, the other pickups are done. At the end of a working day, the driver drives back to the terminal. Then the shipments are sorted at the terminal in order to send the shipments to their right destination. During the night and early morning, the shipments are driven from the pickup terminal to the destination terminal. When they arrive in this terminal, the shipments are sorted again according to the destination address. In the morning, the sorted pieces are ready for delivery and the cycle starts again.

The pickup and delivery process is divided into two kinds of tours: tours with small vehicles (vans) and tours with large vehicles (trucks, tractor-trailer combinations). The van tours are mainly transporting parcels and these parcels can mostly be handled manually or with a trolley. The truck tours are mainly transporting pallets and the driver uses a pump car to handle the pallets. The non-conveyable pieces are transported by both type of tours, regarding the size and weight.
3.5 The DD domestic and DD International network

The previous sections described the services, units and processes that are performed to transport the shipments from sender to receiver. This section describes the network. However, the term network is not unambiguous. In the transport industry a network can be defined as follows: “a transport network facilitates making a trip from an origin to a destination for a specific mode.” (van Nes, 2002, p. 66) In other words: the network is the organisation of the transportation.

Networks can be described in two ways (van Nes, 2002, p. 67):

• As a collection of nodes and links:
  o A node is “any concentration point/area where public transport activity takes place”. A node can have two functions: a collector/distribution function and a transfer function. (Pienaar, Arnold, Motuba, & Baloyi, 2007, p. 46)
  o A link connects two nodes with each other by transportation between the two nodes.

• By using specific network forms.

The network as a set of nodes and links is not explained in this section, since the links are already explained in the previous section about processes and the nodes are explained in the next section. This section will use the second definition to explain the way transportation is organised. The section is divided into a DDD network part and a DDI network part and explains the specific network form for the terminal to terminal transportation. Furthermore, it ends with a sub section about extra complexity of the network.

3.5.1 Day Definite Domestic (DDD) network

The first sub network is the DDD network. This network does not have a specific network form, but can be called a web-structured network. Furthermore, the network can be described as a neutral and complete network. This network structure is shown in Figure 3-5.

In principle, there are line hauls from all 14 terminals to all other 13 terminals and even to the terminals in Belgium and Luxembourg. In total, the DDD network consists of 586 line hauls as a maximum, driven by around 10 vehicles. This network is called the Benelux Net. However, if the volume that must be transported is not enough, the volume for different terminals are clustered and transported in one truck. When this situation occurs, the network is a neutral and incomplete network. In this case, not all the line haul tours are used and not all vehicles are used. (See Figure 3-6 for an example) The trucks driving in this network drive from terminal to terminal but always start and finish at the same terminal, since the vehicles do not belong to the network but belong to a certain terminal.

This network is an impure network since it also transports Day Definite International shipments. The pickup and delivery of the DDI network is partly done by the DDD network.
Figure 3-7 shows the DDD network. For clarity reasons, only some line hauls are present in this figure. In the actual situation, there are line hauls between all the terminals.

3.5.2 Day Definite International (DDI) network

The second sub network is the Day Definite International network. This network is a hub and spoke network and consists of 14 terminals and 1 gateway. A gateway is a terminal, specialised in international shipments. There is one gateway in The Netherlands that receive all the international Day Definite shipments. Those shipments are sorted at this location, according to their destination. From the gateway an international line haul departs to the arrival gateway in of the approximately 40 countries served by the DDI service. (DHL Express NL, 2009)

The specific network form of the Day Definite International network is a radial-structured network. This is also called a hub and spoke network and is commonly used in air transportation. Figure 3-8 shows an example of a hub and spoke network. (van Nes, 2002)
The DDI network transports the DDI shipments. The pickup of these shipments is largely done by the DDD service and delivery is totally taken care of by the DDD service. The gateway process of the DDI service is unique; however, this process takes place in the DDD terminal in Eindhoven. Figure 3-9 shows the DDI network. (Herrebout, 2010)

![Figure 3-9 Day Definite International network](image)

### 3.5.3 Extra complexity of the network

From this section can be concluded that the complete DD network is rather complex, because of the two sub networks and the impure domestic network. This section illuminates other forms of DD network complexity.

**Day Definite Expresser product**

The first type of extra complexity is the time bound delivery of the Expresser products. The Expressers only occur in the domestic network. These shipments must be delivered before 11:00hr. This restriction influences the delivery order of shipments and it thus influence the route that is taken during a tour. This may counteract the route efficiency. According to the data of June 2010, around 30% of shipments is an Expresser shipment. (DHL Express NL, 2010c)

**Parcels shipped by a large vehicle tours**

In general, parcels are delivered by a van tour. In some occasions, parcels are delivered by a truck or tractor-trailer combination. For example, when the amount of parcels is very high or when the addressee of the parcels also receive pallets on that day. In those situations, the parcels are...
shifted from a van tour to a truck tour. This action benefits the efficiency of the delivery process. However, it also requires extra planning effort. The advantages outweigh the disadvantages, but it leads to an increased complexity of the network.

**Pickups during a fixed time-slot**

Another issue that make the network more complex is the delivery time slots of customers. On the one hand, satisfy the customer by respecting the desired time slot for picking up or delivering the shipments contributes to the service level and thus to the customer's satisfaction. On the other hand, the time slots are detrimental to the efficiency of the pickup and delivery process. At the moment, the situation occurs that the driver has done all the deliveries and has to wait to start with the pickup of shipments, since it is too early to pick them up.

### 3.6 Physical layer – resources

The final section to describe the company is about the physical aspects of the system: the buildings (terminals), the vehicles and the employees. The physical infrastructure make it possible to offer the extensive network and thus a high service level. This section elaborates on the terminals, the vehicles and the employees respectively.

#### 3.6.1 Terminals

A terminal is a location where all the shipments of a certain region are collected, sorted and distributed to another location for further transportation or distributed to the receiver (delivery process). The terminals are the nodes in the network, when describing the network as a set of nodes and links. As described in Chapter 2, there are 14 DD terminals in The Netherlands. Figure 3-10 shows these terminals.
Overview of DD terminals:
1. Drachten
2. Alkmaar
3. Zwolle
4. Amsterdam
5. Hengelo
6. Amersfoort
7. Utrecht
8. Den Haag
9. Rotterdam
10. Arnhem
11. Den Bosch
12. Roosendaal
13. Eindhoven
14. Maastricht

The Netherlands is divided into two regions: A Northern region and a Southern region. Terminals 1 to 7 belong to the Northern region and terminal 8 to 14 to the Southern region. Some of the terminals only process Day Definite shipments; others also process Time Definite shipments. However, these processes are performed completely separately.

Terminals have two functions: they function as pickup terminals and as delivery terminal. As a pickup terminal, the building offers the facilities to sort the shipments according to the destination terminal (DDD shipments) or gateway (DDI shipments). As a delivery terminal, the building offers the facilities to collect the shipments from other terminals (DDD shipments) or from the gateway (DDI shipments) and to sort these shipments according to their destination in the neighbourhood of the terminal.

The process that takes place at a terminal is called the terminal handling process, or: the TH process. Figure 3-11 shows an example of the current terminal layout of Zwolle. The figure is not readable, but it gives an idea of a terminal layout. The light yellow part in the middle is the sorting machine, the small part at the right is for small vehicles and the part at the left is for large vehicles.
A gateway is a specialised terminal for international shipments. Shipments enter and leave a country via a gateway. It means that the gateway pieces must be checked by the customs before they can be loaded into a truck and before they can be transported to the inbound terminal. This procedure is only required for the Day Definite International shipments that have a destination outside the European Union. The gateway of the DDI network in The Netherlands is located in Eindhoven in the same building as the DD terminal.

3.6.2 Vehicles

DHL has an extended fleet of several modes of transportation worldwide, like vehicles, airplanes, vessels, boats and even bicycles. Within The Netherlands, vehicles are the main transportation mode for the DD service and will be discussed in this paragraph. The road transportation fleet roughly consists of small vehicles and large vehicles.

Small vehicles

There are several types of small vehicles (also: vans): the small commercial vehicles (SCV), the medium commercial vans (MCV), the large commercial vans (LCV) and the extra large commercial vans (XLCV). Figure 3-12 shows an example of a small vehicle. These smaller vehicles are used for the tours without pallets, as explained earlier. These tours are called (parcel) van tour or in Dutch: 'kleingoed' (KLG) tour. For this project, the difference between these vehicles is left out of scope to simplify the situation. However, one distinction is made: vehicles that require a B driving license and vehicles that require a C driving license. In December 2010, DHL owned vehicles that require a B driving license and vehicles that require a C driving license, which are deployed to drive parcel van tours. (DHL Express NL, 2010f)

![Figure 3-12 Small DHL vehicle (van)](image-url)
Large vehicles
There are several types of large vehicles as well: trucks and trailers. A truck is "a large road vehicle which is used for transporting large amounts of goods". (Cambridge Online Dictionary, 2010) In general, a truck requires a C driving license. However, one type of truck requires a CE driving license. A trailer is "a box on wheels that is pulled by a car and is used for taking things from one place to another". (Cambridge Online Dictionary, 2010) These trucks and trailers exist in several appearances. When the amount of transported goods is very high, a truck and trailer combination or a trailer and city trailer combination can be used. A city trailer is a smaller truck and can be put behind a trailer.

A trailer must be used in combination with a tractor. A tractor-trailer combination requires a CE driving license. DHL has much more trailers than tractors, a part of the trailers stays thus at the terminal. In December 2010, DHL Express NL owned H tractors and J trailers.

The tractors, trailers and trucks are used for Day Definite routes during the day and for the line hauls between the terminals and gateway during evening and night. The tours during the day are driven by these vehicles, as the pallets fit in those vehicles. These tours are called (pallet) truck tour or in Dutch: 'grootgoed' (GRG) tour. Next to the H tractors and trailer, DHL Express NL owned H trucks in December 2010.

3.6.3 Employees
There are two types of employees present in the DHL Express NL DD system: employees who work in the terminal (terminal handling process) and employees who work as a driver (pickup and delivery process).
Terminal handling personnel works mainly during the evenings and nights, since the shipments are sorted during these parts of the day. The terminal handling personnel consists of forklift drivers, sorter personnel and employees who load the vehicles, in case the vehicles are loaded by the direct load method. The advantage is that the drivers can leave the terminal relatively fast in the morning, since the vehicle is already loaded during the night. In October 2010, the amount of terminal handling personnel within The Netherlands is around the H employees.

The drivers commonly work for the van tours or for the truck tours. In some occasions a driver works for both tours. The group of drivers consists of drivers who only have a B driving license and drivers who have a C or CE driving license as well. The parcel tour vehicles require a B or C driving license. The truck tour vehicles require at least a C driving license and a part of those vehicles require the CE driving license. The total amount of pickup and delivery personnel is...
The group of drivers includes around the drivers with a B driving license and drivers with a C driving license.

The employees have different kinds of contracts. Roughly, there are contracts for a certain time period and contracts for an undefined time period. Each of these types consists of different categories regarding the amount of hours. Some contracts are 0-hour contracts and the employees with such a contract can be deployed in a flexible way. Besides those, there exist contracts with a min/max contract. These employees must at least be deployed for the minimal amount of contract hours, but can be deployed for more hours. So these employees do have a kind of flexibility as well. The third category is the contracts for a fixed amount of hours. These employees must be deployed for the fixed amount of hours a week. Every extra hour is registered as overtime for these employees. This contract category is not flexible at all.

Next to the differences in hours, there is a difference in employees. DHL Express can choose whether a DHL-hired employee or a non-DHL employee is deployed. Non-DHL employees are subcontractors and temps. When a subcontractor is hired, the employee and the vehicle are non-DHL. When a temp is hired, only an employee is hired. For the PuD and line haul processes, mainly subcontractors are hired, since DHL prefers to have a DHL employee in a DHL vehicle. For the terminal handling process, only temps are hired, since there are no vehicles needed for this process.

3.7 Conclusions DHL Express NL

This chapter aimed to clarify the business of DHL Express NL. Transporting shipments from sender to receiver sounds easy, but this chapter showed that the reality is much more complex. DHL Express NL consists of 14 terminals, over drivers, over vehicles and ships over shipments a year.

The Day Definite consists of two networks that are partly joined. The complexity of the pickup and delivery process is mainly because of the Expresser products that must be delivered before 11:00hr, the parcels that are sometimes delivered by a truck tour instead of a van tour and the pickups that must be done within a certain timeslot. The complexity during the night is mainly caused by the large amount (as a maximum) of tours that all start from the 14 terminals in The Netherlands and the fact that the pieces must be at the right place in time, as the pieces are sorted again in the early morning for delivery. This must be ready when the drivers start their working day in the morning.
4 Performance measurement in general

The previous chapters explained the problem statement, the project objectives and approach, and gave an overview of the company DHL Express NL. This chapter is about performance measurement in literature and the multidimensional problem concerning performance measurement that must be dealt with in this project.

4.1 Performance measurement in literature

This section goes in depth about performance measurement in general. First of all, it gives an overview of the methods that can be used to measure performance in the field of logistics. Second, the dashboard as a way to display the performance is discussed.

4.1.1 Performance measurement models

Performance measurement is used at every company. However, performance measurement can be done in an infinite amount of ways and there are infinite factors to measure. Performance measurement at a company is mostly done by a supporting (software) tool or model. Measuring performance is done by means of key performance indicators (KPIs). According to the Cambridge dictionary, a key performance indicator is "a way of measuring a company's progress towards the aims it is trying to achieve". (Cambridge Online Dictionary, 2010) KPIs may also be described as "quantifiable measurements, agreed to beforehand, that reflect the critical success factors of an organisation. They will differ depending on the organisation." (Reh, 2010)

However, some standardization is done in defining KPIs by models developed to express the performance of a company. Commonly used performance models in logistics are the balanced scorecard (Kaplan & Norton, 2001), the SCOR model (Supply Chain Council, 2004), the INK model (Instituut Nederlandse Kwaliteit) and the activity-based costing model. (Jeroen van den Berg Consulting, 2006) Next, these models are described and an indication is given of the applicability on this project.

The balanced scorecard of Kaplan and Norton is a strategic planning and management system, which can be used in all kinds of environments (business, non-profit, government). The framework provides insight in the key performance indicators that a company could use to measure the performance and it provides a planning to achieve the formulated strategic objectives. (Kaplan & Norton, 2000) Unfortunately, this framework cannot be used for this project, since it focuses on the strategic term instead of on the tactical term. Furthermore, the framework uses four perspectives to look at the system's performance, while this project only requires looking from a resource point of view.

The SCOR (Supply-Chain Operations Reference) model of the Supply Chain Council is a framework that "integrates the well-known concepts of business process reengineering, benchmarking, and process measurement into a cross-functional framework" (Supply Chain Council, 2008) in the field of Supply-Chain management. The framework consists of four models: the Business scope diagram, the Geographical map, the Thread diagram and the Workflow or Process models. Equal to the Balanced Scorecard, the framework identifies the most important performance indicators to measure performance. The framework is widely applied for supply chain management. The model is less usable for this project, since it is not focused on supply chain management. However, some of these key performance indicators may fit with the project.
The INK (Instituut Nederlandse Kwaliteit) model of the INK organisation is used for self reflection of a company. It measures the majority of a company and it identifies the points of improvement. The model consists of nine buildings blocks that determine the success of a company. These blocks are divided into two parts: an organisational part and a results part. (INK, 2010) One of these aspects is resource management. However, the philosophy of the model is to cooperate and grow on all nine aspects. Furthermore, the focus is mainly on quality rather than on resource utilization. The INK model is not suitable too, because of the scope of the model.

The fourth model is the activity based costing (ABC) model. The name already explains that the costs are observed from an activity point of view. It connects the costs for resources to certain activities and it connects the activities to the products or services. (Damme, 2001) This method is very useful for the project, since it provides insight in the costs structure and accountability of the different services. Such a cost-based analysis is already performed at DHL Express NL about two years ago. However, for the scope of the project, it is too much focused on the financial perspective instead of the Operational perspective. It would be recommended to connect the ABC analysis to this project afterwards.

Concluding, there are many ways to measure performance in logistics. The specific needs determine which model is most suitable in order to achieve the objective. The four models described in this section are all useful for companies active in the field of logistics, but unfortunately the scope of the models do not fit in the scope of this project. The main reasons are that the scope of the models is too broad and meant to use at a strategic level instead of a tactical management level. Therefore, it is not possible to construct a dashboard based on one of these models and the key performance indicators must be defined in this specific project. However, a dashboard can still be used to display the identified KPIs.

### 4.1.2 Displaying performance by means of a dashboard

The Operations management team has indicated that it would like to have a dashboard that displays the performance on resource utilization and flexibility. Also from literature it appears to be the best way of presenting the performance at a tactical management level.

A performance dashboard can be described as “a commonly used management tool to gauge performance and progress toward business goals.” (Kawamoto & Mathers, 2007) A dashboard is not a model itself. The dashboard can display the company's performance based on historical data or based on a simulation model for example. A simulation model can be used when there is not enough data available. Stochastic variables can be used to simulate the actual situation. The right choice for a tool that displays the performance depends on the decision-making level the tool is used for. From a high to low business level there are scorecards, dashboards and reports respectively. “The goal of a scorecard is to keep the business focused on a common strategic plan”, while the goal for the dashboard is “to provide the user with actionable business information in a format that is both intuitive and insightful”. Reports are especially useful when “the user needs to look at raw data in an easy to read format”. (Gonzalez, 2007)

The dashboard is the most suitable tool for this project, since it is meant for support on the medium long term decision-making process and it is more focused on operational goals than of strategic goals. Furthermore, the 'actionable business information' fits the description of the Operations management team's needs the best.

For this project, the data behind the dashboard is historical data, since DHL Express registers so much data, that all data for the calculation of the resource utilization and flexibility is available. However, the dashboard must also predict the performance for the medium long term. In this case, it is necessary to use historical data and some stochastic variables to simulate the future performance. Nevertheless, the same dashboard can be used to display the performance.
4.2 The definitions of utilization and flexibility for the project

The terms utilization and flexibility are frequently mentioned so far. However, an accurate definition was lacking. This section set the definitions for the terms utilization and flexibility by using literature in which these terms are defined before.

4.2.1 The used definition of utilization

The type of utilization that is meant in this project is capacity utilization. Capacity utilization can be defined as the ratio between the "actual level of output and the sustainable maximum level of output, or capacity." (Corrado & Mattey, 1997)

The actual level of output is the actual usage of the (available) resources of a company, like the used machines, vehicles, employees, etc. The term capacity is less unambiguous, since the capacity can be expressed in several ways.

According to a working paper of The Levy Economics Institute, two kinds of capacity can be distinguished. First the engineering capacity, which represents "the maximum sustained production possible over some interval." This is more or less equal to the definition from Corrado and Mattey. Second the economic capacity, which represents the "desired level of output from given plant and equipment." (Shaikh & Moudud, 2004)

The project works with the first mentioned definition, since the last mentioned one leads to the most cost efficient capacity. It undoubtedly is an interesting factor to include in the project, but due to time limits, just the engineering capacity is taken into account, since the economic capacity needs some extended optimisation calculations. The definition in formula-form looks as follows:

\[
\text{Capacity utilization} = \frac{\text{actual usage of the (available) resources}}{\text{the maximum sustained production possible over some interval}}
\]

Figure 4-1 shows this definition in an applied form for DHL Express NL. The usage of resources is obvious. The capacity of DHL Express NL is all the resources that DHL owns and the employees that have a permanent contract at DHL Express.

During operations, two situations can occur: the usage of resources is less than the capacity of DHL Express NL and the usage of resources is equal to the capacity of DHL Express NL and it is even desirable to have more resources available.

In the first case, spare capacity exists. DHL Express could handle more pieces with the same amount of resources. The situation is not efficient, since there is a surplus of resources which means that the resources are unused some time. Besides, this also has a financial consequence, since the price per piece increases.

In the second case, friction costs have to be made, since it is needed to arrange some extra capacity. Using all the resources that are available is very positive, since it means that the costs per piece are lower than in the first case. However, if extra capacity is needed, this has financial consequences as well. The extra capacity must be hired and must be paid. When no extra capacity is hired, the process may become less efficient as a result because of the undercapacity: it is possible that a piece has to be handled twice or thrice for example.
4.2.2 Used definition of flexibility
The need for manufacturing flexibility is clarified by Koste and Malhotra by stating that global competition, rapidly changing techniques and shorter product life cycles contributed to a very competitive field. (Koste & Malhotra, 1999) Customers ask for products and services of high quality and low prices. Flexibility is one method to achieve a higher quality, while keeping the costs low.
The term flexibility is vague and embraces many aspects. However, in general, it can be described as "the ability to respond fast on changes". (In 't Veld & Bikker) In literature about manufacturing flexibility, many different aspects of flexibility are discussed. Aspects as, machine, labour, material handling, routing, volume and mix flexibility are mentioned several times. (Zhang, Vonderembse, & Lim, 2003)

However, DHL Express does not produce a product, but offers a service. Flexibility in services works differently from the producing companies. Five major differences can be identified according to Jean Harvey, Louis A. Lefebvre and Elizabeth Lefebvre. First, the flexibility in the contact between service provider and customer is very important. Second, the customers ask more and more to bunch the services while they are delivered. Third, services must be produced when they are demanded. Fourth, the growth of Information Technology (IT) creates many opportunities. For the service provider, it is more easily to re-engineer compared to the manufacturing companies. Finally, self-service as an alternative for purchasing is more likely for customers of service providers than it is for customers of manufacturing companies. (Harvey, Lefebvre, & Lefebvre, 1997) Flexibility dimensions that play a role in companies that provide a service are volume changes, time and place, needs and customers.

For this project, these aspects are all important as well. The volume that is offered by the customers has a certain pattern. For example, Monday and Friday are relatively quite days; Tuesday, Wednesday and Thursday are relatively busy days. Time and place are also important components. Customers want their products delivered as soon as possible, but wants to pickup of their products at the latest time possible. Different needs for a customer occurs when a customer would like to ship several kinds of shipments. Not only for a shipment of several pallets but also for a shipment of one small box, which must be as soon as possible on destination. Different customers have different needs. This also requires certain flexibility of DHL. Therefore, customised solutions are offered by the Marketing & Sales department in order to keep every customer satisfied.

Concluding, defining flexibility is not easy at all. However, it is necessary to define the term flexibility for the whole project in order to prevent miscommunication. The four dimensions of flexibility for service providers all require flexibility in the deployment of the resources in order to offer the customers the services they want. Therefore, this is chosen to be the aspect which is looked at in the project. Creating variability makes it possible to be flexible. However, the variability of resource deployment must not be too expensive; otherwise the extra offered service outweighs the extra costs. The most suitable definition for the project thus is:

*Flexibility is the variability in the deployment of the amount of resources that do not have financial consequences if they are not deployed.*

4.3 Performance measurement for the project: a multidimensional problem
The previous sections explained the commonly used models for performance measurement and identified the definitions of utilization and flexibility for this project. This section goes more in depth about the complexity to measure the right performance for this project, since the existing
models are not satisfying. Hereto, four dimensions are identified that together embrace all aspects of performance measurement for the project.

4.3.1 First dimension: Performance categories

The first dimension is about the available performance categories. The previous sections made clear that performance measurement includes a wide range of possibilities. A literature research is conducted in order to get an overview of the different aspects of performance measurement. In 't Veld and Bikker identified such aspects, effectiveness, productivity, efficiency, flexibility, ability to control the system and quality & the ability to be innovative. (In 't Veld & Bikker) Hereafter, the six categories are discussed.

The first category is effectiveness and is commonly described as “doing the right things”. (Pryor, 2006) According to In 't Veld and Bikker, the effectiveness can be expressed as the actual result divided by the aimed result. An example of DHL is a certain percentage of shipments that must be delivered on time. The effectiveness has a customer perspective. It compares what result the customer expects versus what result the company has achieved. Important issues for the effectiveness are the requirements for the product and the satisfaction level of the customer.

The second category is efficiency and is commonly described as “doing the things right”. (Pryor, 2006) According to In 't Veld en Bikker, the efficiency can be expressed as the estimated offers divided by the actual offers. The efficiency has a company perspective and is linked to costs. Important issues for this category are the capacity requirements of the resources and a fluent operations process.

Productivity is a resultant of effectiveness and efficiency and it is a measure to indicate what result is achieved with a certain amount of offers. (In 't Veld & Bikker) The productivity is not one of the categories, since it is a resultant of two other categories. However, it is wise to have the definition of this term clear. The productivity of DHL can for example be expressed as the amount of shipments or pieces that could be handled with a certain amount of resources and in a certain time period.

The third category is flexibility and can be expressed in a lot of ways. However, in general, it can be described as “the ability to respond fast on changes”. (In 't Veld & Bikker) The previous section already explains the term flexibility.

The fourth category is the ability to control the system and is about the aspects that need to be controlled and about the requirements of those aspects. An example for DHL would be to look at the aspects that control the sort process.

The fifth category is quality and is about the content of the function within the company. Requirements for the quality of work on a policy level implicate requirements for the organisational structure.

The final category is the ability to be innovative and this expresses to what extent it is possible to evaluate a subsystem and furthermore, it is how to submit proposals for improvements. These initiatives must eventually lead to an increase in the product quality.

The utilization of resources belongs to the efficiency category, since it is about doing this right: resources must be used as much as possible in order to create the lowest costs per piece. If the things are done right, the utilization of the resource would thus be 100%. The flexibility of resources is simple to match with the right category: it obviously belongs to the category flexibility. The other categories are not left out of scope now, since it is valuable to have an overview of the whole range of performance categories.
4.3.2 **Second dimension: Processes**

In Chapter 3 the processes that take place at DHL Express are described. The pickup, line haul and delivery process are described in the section about the processes; the terminal handling process, is described in the section about networks.

From a utilization point of view, the same division of processes can be made. The utilization of the pickup and delivery process can be defined, as well as the line haul process and the terminal handling process. In order to express the utilization of a process, the utilization of the used resources must be expressed first. Figure 4-2 presents the main resources per process.

![Figure 4-2 Subdivision of the utilization of DHL Express](image)

### Pickup and delivery process

Several resources are used for the pickup and delivery process. For example the different types of vehicles, the drivers of the vehicles and the pump cars or trolleys in the vehicles. The pump cars and trolleys are not taken into account, since these belong to a certain vehicle and will be used when necessary. It would be cumbersome to let the equipment rotate between different vehicles. The doors are the final type of resource that is taken into account. The amount of doors determines how many vehicles can be loaded simultaneously. Or if the small vehicles are loaded in the terminal: the terminal surface available for vehicles determines how many vehicles can be loaded at the same time.

### Terminal handling process

The resources for the terminal handling process are the sorter, the terminal handling equipment, the personnel, the floor space and the terminal doors. The sorter is the most expensive resource within the terminal building with respect to the purchase costs and it is essential for the sorting process.

The equipment used in the terminal mainly consists of Electric Pallet Trucks (EPTs) and forklifts. An EPT is equipment that can lift pallets. The EPT is controlled by a person that is located on the terminal floor. A forklift is equipment that also can lift pallets. The difference is that the driver is sitting on the vehicle itself.

The employees of the terminal handling process mainly support the sorting process. The floor space is the terminal surface, which can be used for the terminal handling process. There are areas behind every door, which are meant to store pieces before they can be loaded into the vehicle. These areas are called staging areas.

Finally, the terminal doors are resources as well. These doors are especially important for the Inbound process, because they can be the bottleneck of this process if the volumes are very high, since the doors are a restriction of how many vehicles can be loaded simultaneously.
Line haul process
The resources of the line haul process are similar to the ones for the pickup and delivery process. The terminal doors play an important role here as well, since the number of doors is important for the arrival and departure of line haul vehicles. When all line haul vehicles arrive at a terminal at the same time, there will probably not be enough doors to handle all trucks simultaneously and the trucks will delay.

4.3.3 Third dimensions: resource types
Figure 4-2 showed the resources per process. It can be concluded from this figure that some resources are used for more than one process, like the personnel and the vehicles. For this reason another subdivision is made: the resources are split based on the type of resources. Three types of resources can be distinguished: personnel, vehicles and building related resources. Figure 4-3 shows the types of resources and a more detailed subdivision of these types.

![Capacity utilization]

- **Personnel**
  Drivers can be divided into two categories. Drivers that drive in small vehicles. Those drivers transport shipments for Kleingoed (van tours, also abbreviated as KLG). Drivers that drive trucks or large tractors with trailers. During the day they transport shipments for Grootgoed (truck tours, also abbreviated as GRG) tour. During the night they transport shipments for the line haul network.

- **Vehicles**
  As explained in Chapter 3, vehicles can be divided into vans, trucks and tractors-trailer combinations. Every category consists of several types of vehicles

- **Building related resources**
  There are many different resources at a terminal. For this project, the four most important ones are listed. These resources are the sorter, the forklifts & pump cars (also: the equipment), the floor surface and the terminal doors.

4.3.4 Fourth dimension: locations
The fourth and final dimension is the locations. The performance on utilization and flexibility of resources differ between the different terminals. The deployment of vehicles and employees is organised at a terminal level and not at a central level. Since the terminals form a network, the performance of one terminal influences the performance of another terminal. For example: the vehicle capacity of a terminal is reached when all vehicles are used. As a consequence the terminal cannot handle any more pieces. It is possible that one terminal reaches the capacity, while another one does not reach it yet. In this case, the first mentioned terminal is the bottleneck
of the system and determines the capacity of the whole system. Therefore, it is important to look at the performance at a terminal level as well as a system level.

4.4 Conclusions performance measurement in general

Commonly known performance measurement models in the field of logistics are the Balanced Scorecard, the SCOR model, the INK model and Activity-Based Costing. However, the scope of these models do not fit in the scope and the business level of the project. Therefore, a dashboard is constructed that specifically displays the performance at resource utilization and flexibility by means of key performance indicators.

Utilization is defined as the actual usage of (available) resources over the maximum sustained production possible over some interval. Flexibility is defined as the variability in the deployment of the amount of resources that do not have financial consequences if they are not deployed.

Measuring the right performance for this project is a multidimensional problem. Dimensions that can be identified are performance categories, processes, resource types and locations. Six performance categories are identified according to In 't Veld and Bikker. These categories are the effectiveness, the efficiency, the flexibility, the quality, the ability to control the system and the ability to be innovative. The processes consist of the pickup and delivery process, the line haul process and the terminal handling process. These processes use different resources. Therefore, the third dimension that is identified is the resource types, which can be split into personnel, vehicles and building related resources. The final dimension is the locations. DHL Express DD has 14 terminals in The Netherlands.
5 Performance measurement at DHL Express NL

The previous chapters of the conceptualization phase provided the necessary knowledge about the company (which is needed to understand the business) and about performance measurement. The previous chapters also clarified that the KPIs for the project must be defined. The definition of KPIs is a difficult task. This chapter is about the activities that are undertaken to formulate the KPIs. These activities are shown in Figure 5-1.

Three activities are done to find out which KPIs are useful and necessary to display on the dashboard. These three activities result in a long list of KPIs, which is reduced twice to end up with the first version of the KPIs.

The first activity is conducting a system analysis. The system analysis clarifies the most important factors that influence the resource performance. The second activity is the process analysis. This activity led to a detailed process description and furthermore, it led to an overview of the indicators that reflect the performance of each sub process. The final activity is an exploration of the existing reports, dashboards and scorecards at DHL Express NL Operations that are used to express the performance. This chapter discusses these three activities in succession.
5.1 System analysis

The system analysis introduces the main system factors that play a role in the performance of DHL Express. The understanding of the whole system is necessary to be able to assess which parts are the critical success factors of an organisation, regarding the utilization and flexibility of resources. And this is what the KPIs aim: "Key Performance Indicators are quantifiable measurements, agreed to beforehand, that reflect the critical success factors of an organisation." (Reh, 2010)

5.1.1 DHL Express system overview

According to In 't Veld and Bikker, performance measurement can be divided into six aspects, as explained in section 4.3.1. The ability to innovate and the ability to control the system are out of scope for this project and thus not included in the system analysis. The quality is taken into account as a precondition for the project: it is assumed to be sufficient at the moment. The project would be even more complex if the interdependency of the service's quality on the one hand and the utilization and flexibility of resources on the other hand were included. The other four aspects, effectiveness, efficiency, productivity and flexibility are taken into account in the system analysis.

The result of the system analysis at an aggregated level is shown in Figure 5-2. The four performance measurement categories are depicted in yellow. These factors are (direct and indirect) influenced by several groups of factors: external factors (red), in-system factors (grey) and factors that can be influenced by DHL Express (blue).

First, the external factors influence the system of DHL Express NL, but cannot be influenced by DHL Express itself. The main external factors that influence the amount of volume are the financial situation competition on the Express market in The Netherlands, as explained in Chapter 2. Second, the blue factors influence the system of DHL Express NL as well, but these factors can be influenced by DHL Express itself. These factors are also called measures. Examples are the amount of fixed production means of DHL, the tariff and the number of non-DHL production means. Finally, the in-system factors are factors that are influenced by external factors and measures. These influence the criteria in a direct or indirect way. A very important in-system factor is 'volume' (green in-system factor), since this is a very important factor. To what extent the resources are used mainly depends on the volume that is offered by the customers of DHL. The amount of volume affects the amount of resources that needs to be used. Besides that, the way of using resources play a role. However, this role is of minor importance compared to the volume's role. The relations between the factors are explained in the next section.
5.1.2 System's interdependencies
The system is split into two parts by a dotted line. This line roughly indicates the boundary between the Operations department and the Marketing and Sales department of DHL Express. However, this boundary is a soft line, since the Marketing and Sales and Operations department communicate about tariffs and customised possibilities for customers.

The volume (parcels, pallets and non-conveyables) is the connecting link between the Sales and Operations department. The main objective of Sales is to acquire volume in order to generate revenue. The amount of volume is thus the result of the performance of the Sales department. On the other hand, the volume forms the input for the Operations department, since it is the main objective of Operations to offer the customer the required service with as little costs as possible. The alignment between Operations and Sales takes place on an ad hoc basis at the moment. Therefore, the idea is to bring both departments more together.

There are two dotted blue lines. Those lines explain the relation between volume and non-DHL production means and volume and DHL flexible means. The lines indicate that the amount of flexible production means that what is deployed is based on the actual volume that must be handled. However, the flexible production means are still measures and can be influenced by DHL Express itself.

Creation of volume
The volume is affected by the amount of customers and the amount of volume that the customers would like to transport. The amount of customers is influenced by external factors as well as by measures. Competition on the Express market in The Netherlands affects the amount of customers in a negative way. The tariff has a negative influence on the amount of customers and the acquisition and service flexibility for customers lead to a high attractiveness and probably thus to more customers.

The amount of volume per customer is affected by the external factor financial situation and by the measure tariff. The amount of volume sent by a customer will increase when the financial situation will deteriorate. The tariff will also have a negative influence.

Available resources
This volume must be handled by the available resources. These resources consist of building related resources, vehicles, and personnel. The resources can also be divided into non-DHL production means and DHL-owned productions means. Production means can be divided in two categories: flexible and fixed production means. The flexible production means are the non-DHL production means and the DHL-owned flexible production means. DHL-owned flexible personnel can be DHL-owned personnel with flexible contract hours or it can be overtime for personnel with a fixed contract.

The fixed production means are DHL-owned production means (with fixed contracts). For example a DHL-owned building, a hired building with a long term lease, a DHL-owned vehicle or an employee with an indefinite contract.

The production plan is a planning that gives an overview of the resources' deployment and results in a schedule for drivers and vehicles. The effect on the scheduled amount of resources is difficult to describe, since the production plan cannot increase or decrease. However, it is important to mention that there is a measure that determines how many vehicles and drivers are scheduled, based on the available amount of resources and the expected amount of volume.

Planned and actual operations
The production plan results in a schedule and thus in an overview which indicates the amount of hours that a resource is scheduled. The production plan is based on forecasts, for examples on volume forecasts. The actual volume, the maximum available amount of resources and the
scheduled amount of resources determine how many resources are used: this can be called the actual usage of production means. The efficiency is calculated by the used resources (flexible and fixed) in relation to the maximum available amount of resources. The flexibility of resources can be calculated by the flexible resources in relation to the fixed resources and in relation to the volume that is delivered by the flexible resources. The relation between volume and flexibility is added, since the flexibility is interesting to express as part of the volume. For example, 15% of the volume is delivered by hired vehicles (rental or subcontractor) and 85% by own deployed vehicles.

5.1.3 Underlying factors of the system

The previous section showed the system at a high aggregation level. It presented the main factors that influence the performance of the effectiveness, efficiency, productivity and flexibility. The productivity, efficiency and flexibility can all be determined from a resource point of view. However, the effectiveness is more difficult to determine. In Chapter 4 the effectiveness is defined as the actual result versus the aimed result. The actual result may be expressed in the volume that is handled, if it is looked from a resource perspective. The aimed result would then be the forecasted amount of volume. Since an accurate forecasted amount of volume is not available at national level, the effectiveness is difficult to express in terms of resources and resource usage. The system analysis criterium for resource efficiency is equal to the resource utilization that is described in Chapter 4. Below, the underlying factors of each criterium are explained, except for the effectiveness, since it is not possible to calculate this criterium in the end.

Underlying factors of resource utilization

The utilization can be calculated by the quotient of the usage of the production means and the capacity (available production means). The used production means consists of the DHL production means and the non-DHL production means. In general, the non-DHL production means are always used, since they are only hired when necessary. However, the situation occurs that vehicles are hired for more than one day and that the vehicle is not used every hired day. In this situation, the utilization of the non-DHL resources is not 100%. However for this project, the simplification is made that every hired vehicle is used, since this rarely occurs.

Next to the division between DHL production means and non-DHL production means, a division can be made between the resource types, like at Chapter 4: personnel, vehicles and building related resources. The non-DHL means only consists of vehicles and employees. The terminals of DHL are all DHL-owned or rent by DHL. The vehicles can be split further in vehicles that require a B driving license, vehicles that require a C driving license and vehicles that require a CE driving license (tractor-trailer combinations). This is already explained in Chapter 3. A more detailed explanation of the underlying factors and a graphical overview of this are showed in Appendix D.

Underlying factors of resource flexibility

As explained before, there are many ways to express the flexibility. The resource flexibility of this project will be expressed in terms of personnel and in terms of vehicles, since it is almost impossible to express the building related terminals in terms of flexibility. Flexibility of personnel is created by deploying employees with a variable amount of contract hours, deploying non-DHL employees and deploying employees that are multi-usable. The multi-usability can be expressed as an employee that is deployable for several tasks or as the amount of employees that are able to perform a task versus the amount of needed employees to perform that task.

Flexibility of vehicles is created by hiring non-DHL vehicles. There are two situations as explained before: a vehicle and employee are hired or only a vehicle is hired. Hiring an employee and vehicle is called a subcontractor.
Underlying factors of the resource productivity
The productivity can be calculated by the actual result over the actual offers. As explained at the underlying factors of the resource utilization, the used production means consists of personnel, terminal and fleet factors. The category fleet is again divided into DHL vehicles and rental vehicles; personnel into employees with a DHL contract and extra hired employees.

5.2 Process analysis
Next to the system analysis, it is useful to perform a process analysis. The previous chapters already indicated that insight in the processes is relevant, since the process analysis clarifies the possibilities about measures of sub processes and it provides insight into the bottlenecks of the sub processes.

5.2.1 An applied Steady-state model
Processes can be analyses in many ways. The Steady-state Model is used to perform a process analysis for this project. The Steady-state Model is (among others) part of the Delft System Approach. The model is “a function model for one aspect system in a steady state with equifinality”. (Veeke, Ottjes, & Lodewijks, 2008, p. 77) The Steady-state Model consists of the execution process, the process control loops and function control loops. See Appendix E for the definitions of the different parts of the Steady-state Model.
Figure 5-3 presents the first Steady-state model, which means that this is the most simplified model. The chosen aspect is the product aspect. The model combines the function control, the executing process and the process control in one figure. The bold rectangular indicates the system boundaries. The booking process is out of scope of this project, since it focuses on the operational part of the process.

The sent shipment is provided with a sticker with a barcode (by the customer or by DHL Express), to be able to sort and trace the shipment. If all the requirements are met, the shipment is picked up at the sender. Then the shipment is shipped to the receiver. The shipment is delivered, if the receiver is the right receiver. The shipment is taken back to the terminal, if the receiver is not the right receiver or if the receiver is not at home.

The executed process is supported by two kinds of control: the function control and the process control. The objective of the function control is to transform abstract requirements into concrete operational standards. (Veeke, Ottjes, & Lodewijks, 2008)

The requirements of customers and of DHL itself are the input for the target definitions. These targets define the standards. These are called GSOPs (Global Standard Operating Procedures) at DHL and these are used to execute the processes in order to achieve the quality as defined in the targets. The measured quality is compared to the targets; this results in an evaluation of the quality via reports, dashboards and scorecards.

The process control is introduced, since function control does not take the occurrence of disturbances into account. The process control loops are responsible for a system reaction on disturbances. The process control loops exist of feed forward and feedback loops. (Veeke, Ottjes, & Lodewijks, 2008)

Both feedback and feed forward occur at the process control at DHL. An example of feed forward is that the company can react on a deviation in expected volume by intervention of deploying less or more vehicles and employees than planned. An example of feedback is that if the amount of pieces that are sorted per hour is too low, that it becomes a point of attention the next day in order to increase the amount of pieces that can be sorted in an hour. All the functions of the first Steady-state Model are described into more detail in Appendix E.

The first Steady-state model is expanded by defining the transformation function (shipping shipments from sender to receiver) into more detail. This activity is done twice, which results in a very detailed Steady-state Model. These models are included in Appendix E. The zoom in on sub processes led to the detailed process understanding and clarified which indicators can be used for every sub process to express the performance of the sub process.

5.2.2 An applied and combined Steady-state model and SADT model

As explained before, the Steady-state Model can only present one aspect at the time. However, there are three main aspects that can be recognized: the order flow, the product flow and the resource flow. The previous model used the product flow to represent the processes. For the utilization and flexibility of resources, the resource flow is an interesting aspect as well. The PROPER (PROCess PERformance) model makes those flows clear. (Veeke, Ottjes, & Lodewijks, 2008) Figure 5-4 shows the PROPER model for DHL Express.
A steady state model of the order flow and the resource flow are not developed. Instead, the most detailed Steady-state model of the product flow is combined with a SADT model to provide insight in the product flow and used resources at the same time. SADT is the abbreviation of Structured Analysis and Design Technique and is designed to perform a process analysis. The building blocks of a SADT diagram show the processes. The processes have input, output, a control flow and a supporting mechanism. The figures of the detailed Steady-state model and the SADT model are shown in Appendix E.

5.3 The usage of performance measurement tools at DHL Express NL

The third activity that is performed to gather information about possible KPIs is an exploration of the existing reports, dashboards and scorecards in order to find out what is already measured. The first sub section describes which measurement tools are already used within DHL Express NL Operations. The second one describes the content of those tools.

5.3.1 Usage of performance measurement tools

Performance measurement tools are commonly used tools within the organisation of DHL Express Operations. At a national management level as well as at a terminal level, these tools are used to analyse the performance of the operations. Examples of those dashboards are the weekly dashboards, scorecards and performance management tool (PMT) reports.

The dashboard constructed in this project is meant for the Operations management team that take decisions at a tactical level (amongst others). These managers are the managers shown in Figure 3-3. The Managing Director and the Ground Operations Managers North and South are the managers that will probably use the results of the dashboard the most. Those managers are asked about the dashboard they are currently using. All three managers are using dashboards.

The Ground Operations Managers are mainly using a weekly dashboard (Figure 5-5 and Figure 5-6) and a scorecard (Figure 5-7). The weekly analysis presents the performance at the processes on a weekly basis at a terminal level and at a system level. The dashboard is used to detect trends and to be able to improve the processes. The scorecard is used monthly to observe the results of
the terminals. The scorecard uses targets, which makes it possible to see whether a KPI has become a sufficient value or not. The scorecard is used to assess the terminal manager's quality. The Managing Director uses performance measurement tools to identify and prioritize the focus points because of his limited management time. The main tools are the weekly dashboard, a dashboard of the European results and some dashboards that are viewed ad hoc.

Next to these dashboards and scorecards, reports are used as well. Reports are especially useful when "the user needs to look at raw data in an easy to read format". (Gonzalez, 2007) Examples of those reports are the Actual Time Monitor and the Warehouse Terminal Handling (WTH) report. Concluding from this section, the Operations management team already uses some dashboards and scorecards for their job. The familiarity of dashboards is an advantage for the implementation of the dashboard about the utilization and flexibility of resources, since the managers are used to work with such files.

5.3.2 Content of dashboards
The dashboards and scorecard that are described in the previous chapter, like the weekly dashboard at a terminal level primarily, focuses on service performance and quality. Examples of those KPIs are % support hours of the total hours, % shipments delivered and % right sorted outbound pieces. The weekly dashboard at a national level also takes the personnel performance into account, like the illness rate.

The monthly scorecard is divided into four categories: the productivity/financial index, the service performance index, the process compliance index and the personnel performance index. Those categories contain several KPIs. Examples of those KPIs are pickup & delivery costs per stop, on time delivery Expresser and on time departure line hauls.

The operational reports sometimes contain data about the utilization of resources, for example about the amount of used vehicles and the total working time. However, the reports mainly use one point of view to construct the report: only from an hours-registration point of view or only
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from a route point of view for example. There is no dashboard or scorecard that visualises the complete system in terms of resource utilization and/or flexibility.

5.4 Conclusion performance measurement at DHL Express NL

Three activities are performed to create a long list of KPIs: a system analysis and a process analysis are conducted and an exploration of the existing KPIs is performed.

The system analysis clarified the main factors that influence the effectives, efficiency, flexibility and productivity from a resource perspective. However, the effectiveness appeared to be not very meaningful to express in terms of resources, since the forecasted volume is necessary then and the accurate forecasts are not available at a national level. Furthermore, the efficiency of resources is the same as the resource utilization.

The volume turned out to be a very important factor in calculating the efficiency, flexibility and productivity of resources. The volume is determined by external factors like the competition on the market and the financial situation, but also by factors that are influenceable by DHL like the tariff, the acquisition of new customers and the service flexibility that is offered. The efficiency, flexibility and productivity of resources is mainly influenced by the volume, but also by the amount of DHL production means and the amount of hired production means.

The process analysis is performed by applying the Steady-state model. The analysis provided a more detailed insight into the sub processes and the control mechanisms per sub process and the indicators that could measure the performance of the sub process.

The Steady-state model is applied in a very detailed version. This detailed version is combined with an SADT model of the processes. This combination provides insight in the product flow and used resources at the same time.

The third activity is the exploration of existing reports, dashboards and scorecards. DHL employees are familiar to the usage of reports, dashboards and scorecards. This is an advantage for the embedding of the utilization and flexibility dashboard, since this kind of tool is already embedded in the current organisational culture, which makes it not completely new.

However, at the moment the dashboards and scorecards are mainly focused on productivity and quality rather than on the internal resource performance, like the utilization and flexibility. At least not at a dashboard and scorecard level. The operational reports do contain information about the utilization and flexibility of resources, but always from a certain perspective. There is not a dashboard that displays the utilization and flexibility of all main resources. For this reason, it is thus useful and interesting to build a dashboard on the resource utilization and flexibility.

As explained in the introduction of this chapter, the three activities led to an immense list of possible performance indicators. This list is presented in Appendix H. This list is reduced to a short list of possible key performance indicators. The criteria for reduction and the short list itself are discussed in Chapter 8.
Phase 3 - Implementation

The third phase is the implementation phase. Creating a dashboard is useful if it has an added value. However, it really gets an added value when the dashboard meets the expectations of the future users, since they will really use the dashboard in the future. This phase is about the way the Operations management team is involved in order to meet the expectations. It consists of two chapters; the first one is about familiarity, acceptation and commitment and the second one is about the embedding of the dashboard in the organisation.
6 Dashboard familiarity, support and commitment

This chapter is the first chapter of the implementation phase. In this step, the 'mobilising commitment' step of the DHL approach and the 'communicating the vision buy-in' and 'generate short-term wins' steps of the Kotter approach are included. Subsequently, familiarity with the dashboard, support of the dashboard and commitment to the dashboard are discussed.

6.1 Create familiarity with the dashboard

Familiarity with the dashboard is necessary to make the implementation of the dashboard successful and it is the first step in the embedding process as well. Different activities are undertaken to create familiarity with the dashboard for the DHL employees. This section explains these activities.

DHL management conference

The graduation project is part of a much bigger project within the organisation in order to increase the profit margin. On the 30th of June 2010, a management conference took place. The theme of this event was “Growth and Transparency”. The 125 top managers of DHL Express NL came together to be informed, to come up with ideas and to discuss the way DHL Express NL can excel in times of recession. Growth is one of the success factors to achieve this goal. Transparency is needed to be able to grow in an efficient way. Each of the departments made a workshop about the meaning of growth and transparency of their particular department. This management conference made managers aware of the organisational and financial situation of DHL Express NL and clarified the plans of the future. A dashboard about the utilization and flexibility of resources perfectly fits into this theme. The visibility of the resource utilization contributes to the transparency. Growth is needed to use all the resources of DHL efficiently.

Thus, the workshop of Operations was about the dashboard that is developed during this project. For almost all managers, this was the first time that they got familiar with the ideas of the dashboard. Next to this transparency issue, another actual issue for the Operations department is to think of other ways to use the resources at idle time periods during the day.

Conversations

The second activity that is performed to create familiarity is a series of conversations at the beginning of the project. The conversation partners were staff managers of the Operations department in their role before the split between the Time Definite and Day Definite service. The conversations started with a short introduction about the project and from the managers’ side, it started with an explanation of their jobs. The latter provided insight in the company’s activities. After the introductions, the utilization of resources is discussed with the employees. They all gave their opinion about this topic from their job’s point of view.

The managers that participated in the series of conversations had very various functions within DHL Express Operations. (i.e. Managing Director Operations DHL Express Benelux, Director Operations Programs, Director International Operations and Networks Benelux, Director Operations DHL Express (North and South), Benelux net Manager and Director Operations Deployment)

These conversations led to an overview of all aspects of capacity utilization relevant for the Operations department from different points of view, as shown in Figure 4-2 and Figure 4-3.
6.2 Create a basis of support of the dashboard – small surveys

The previous chapter was about the familiarity of the dashboard and the explanation of the position of the project in a much bigger project. This section explains how a basis of support is created. Support exists if someone agrees on or encourages something. It mostly happens if the added value of something is clear. This chapter shows two situations where a basis of support is created to involve the managers in the dashboard development process.

Small survey about performance measurement at DHL Express

The first activity was the conduction of a small survey to the Operations staff managers (the same group as the “conversation-group”). This was just before the split of the TD and DD organisation which caused a new organisational structure. This time the managers were asked to react on some questions about job responsibilities and performance measurement and management. The questions asked to the managers and their answers are included in Appendix F.

Conclusions that could be drawn from these surveys are that the goal of the managers with respect to utilization of resources is relatively similar to each other. However, the focus is different for every function. Goals that were frequently mentioned by the managers were:
- Minimise usage of resources in relation to the volume that must be handled
- Offer a high service for customers
- Minimise costs during the operations

The KPIs that were used to assess the successfulness of the managers varied: from a high level of aggregation to a lower level of aggregation. A notable remark is that most of the managers are judged on effectiveness results and not on utilization results. This underlines the findings of the research to the current performance measurement tools of Chapter 5. A selection of the KPIs that are mentioned by the managers is:
- Operational costs per move
- Customer satisfaction
- Employee satisfaction
- Load factor of vehicles
- Parts per hour (sort process)
- Stops per on route hour
- Availability of capacity

The KPIs form the measuring part of the performance. Furthermore, the managers were asked to give some measures that they could take in order to bring the value of the KPI back in the desired range when necessary, which is more the managing part of the performance. The answers they gave varied from personnel measures, to vehicle measures and building related measures. A summary of those answers is listed below:
- Regarding the employees
  - (no) allowance of overtime
  - (no) deployment of temps
  - (no) permit of leave
  - (no) deployment of DHL employees with a 0-hour contract
  - close or create vacancies
  - (no) deployment of subcontractors
- Regarding the vehicles
  - purchase or sale of vehicles
  - (no) deployment of hired vehicles
- Regarding the buildings
  - close or open a terminal
  - purchase or sale of forklifts
• Regarding the network
  o change tour design or network. (for example a direct tour to the customer that has too much volume to pickup with the regular tour)

The last question that the managers were asked was about the possibilities to express the performance on utilization that are not used at the moment. An interesting answer was the success of risky entrepreneurship. For example: too much vehicles is as bad as too few vehicles. However, only too few resources are designated as a bad result at the moment. The remark that risky entrepreneurship is missing in the evaluation of the performance is an important one in the approach of defining "being successful".

Small survey about the added value of the dashboard
The second survey is conducted after the split of TD and DD. The two Ground Operations Managers and the Managing Director are asked about their opinion of the added value of the dashboard.
The Ground Managers expect an added value on three issues. First, the dashboard provides insight into the development of the resource usage per terminal. This gives the Ground Managers the opportunity to manage this aspect on a structural basis.
Second, the dashboard presents the capacity and the capacity usage of the whole system (= all DD terminals in The Netherlands). This aspect is mainly important for the cooperation of Sales and Operations, since Sales then knows which parts of the system are able to handle more volume.
Third, the dashboard presents the utilization and flexibility of the main system resources. At the moment, all central dashboards and scorecards only present results on the productivity and flexibility. It is necessary to picture the whole system in order to make the best choices. The terminal managers are only able to optimise the result of one location; this dashboard gives the opportunity to optimise the whole system from a utilization and flexibility point of view. And this job can only be done by the Ground Operations Managers.
One important remark that is made at the beginning must be kept in mind here as well: optimising the utilization and flexibility of resources is not the final goal. Using the resources sufficiently is the goal to achieve in order to maximise the profit, which is the final objective.

According to the Managing Director, the dashboard will function as a kind of health check of the total system. The KPIs who tend to the operational side -mainly personnel KPIs- are mainly interesting for the Ground Operations Managers. The KPIs about vehicles and building related KPIs are interesting to use as a starting point in discussions with the Ground Operations Managers to tackle the most urgent problems.
The dashboard does not provide answers in his opinion, but does raises the right questions to achieve the goal. The dashboard reflects the main conditions to be able to run the business well. This means: there must be enough vehicles, terminal space and employees to operate, but there must not be too many.

Both the Managing Director and the Ground Managers think that the decisions taken in the near past would probably not be different when the dashboard was already in use. This partly is because the data about the utilization and flexibility of resources is calculated in an ad hoc manner for important decisions. However, it probably would have made the decision process easier or the decision could have been taken earlier.
6.3 Mobilise commitment to the dashboard – feedback sessions

The conversations and surveys supported the understanding of the whole picture and supported decisions about scoping. Those activities belong to getting familiar with and support something. This section is about commitment. Commitment is more than support; it is described as “willing to give your time and energy to something that you believe in”. (Cambridge Online Dictionary, 2010)

Objective of the feedback sessions

Commitment was mobilised by organising feedback sessions. These took place at a later stadium of the project and aimed to commit the future users, the Operations management team, to the project. From a content perspective, the goal was to get feedback on the KPIs, the functionality of the dashboard and the layout of the dashboard, in order to end up with a dashboard that meets the requirements of the future user. This aim contributes to the embedding of the dashboard into the organisation.

Figure 5-1 clarified the process from conceptualisation to a draft version of the dashboard KPIs. These sessions started with this draft version and aimed to end up with a final list of KPIs, displayed on the dashboard, for the current situation as well as for the future situation.

Set up of the feedback sessions

The Operations management team was invited for the feedback sessions, since they are the future users. Two members of the Operations management team also participated in the conversations and surveys -because of their former function- and the others only participated in these feedback sessions. There were five main meetings in total, with some individual meetings in between those feedback sessions. All the meetings took place between the 12th of October and the 29th of December and the average duration of a meeting was about two hours.

The author of this report was the chairman of these meetings. During the first meeting the aim of the sessions was explained to the managers and the expectations from the author and the managers were discussed. Furthermore, the first session was used as an introduction of the current status of the project and the activities that had been taken so far.

Results of the feedback sessions

The results of the feedback sessions were very positive. The results from a content point of view are discussed in the next chapters. This section deals with the results from a process point of view.

The feedback sessions were successful, since the managers were enthusiastic and curious about the intermediate and final deliverables. This enthusiasm and curiosity were probably the result of the efforts to show the added value for the Operations management team. The added value is explained by discussing the final goals, the current status and the expectations about how to reach the final goals. During the first session, the managers became curious and enthusiastic, which led to the planning of another four meetings with the managers.

Two lessons became clear from the first two meetings:

- Keep the amount of new information per session moderate in order to keep everybody’s attention
- Explain the current situation and the choices that are made to end up with that situation in order to keep the whole storyline understandable

Originally three sessions were planned and one optional session. These originally planned meetings appeared not to be enough to discuss all the aspects that were planned to discuss. Therefore, two other meetings were planned. Appendix G presents the topics per meeting and the interesting results or points of discussion.
6.4 Conclusions dashboard familiarity, support and commitment

The introduction already stated that commitment to the dashboard is important for a successful embedding of the dashboard. Familiarity is created by announcing the project at the management conference on the 30th of June. Furthermore, the staff managers of the Operations department are confronted with the project through conversations about all aspects of the utilization of resources.

A basis of support is mainly created through a small survey about performance measurement at DHL Express and one about the added value of the dashboard. The survey about performance measurement endorsed the findings of Chapter 4 that the performance indicators used at DHL Express NL Operations mainly, or even fully, focuses on the service performance and the productivity of the operations. Performance indicators on the utilization and flexibility of resources do not yet exist.

According to the Managing Director and the Ground Operations Managers, the added value of the dashboard is the structural insight in the performance at resource utilization and flexibility. It functions as a health check. It makes it able to manage the resources and support the communication with Marketing & Sales about the locations of overcapacity in the total system. Furthermore, it enables the Ground Operations Managers to see the capacity of the whole system and take decisions on a system level instead of a terminal level.

The dashboard does not give answers, but generate the right questions in order to start relevant discussions.

Commitment is created by organising feedback sessions in order to involve the management team in the definitions of the KPIs and the layout and features of the dashboard. Five feedback sessions took place and these led to KPI definitions and a dashboard which meet the management team's requirements.
7 Dashboard embedding into the organisation

The previous chapter described in what way the managers of the Operations department went familiar with the project and in what way they are committed to the project. This chapter describes the next step: embedding the dashboard into the organisation. The embedding is successful when the managers are convinced that the dashboard usage had an added value and when the dashboard fits in the organisational culture of the company. The added value is already described in the previous chapter. This chapter starts with the fit in the organisational culture and continues with the consequences of the dashboard’s introduction. The latter explains how the dashboard can be used as a feedback tool. Furthermore, the dashboard owner and dashboard administrator are chosen.

7.1 Fit with the organisational culture

Chapter 5 explained that the use of dashboards and scorecards is not new in the organisation. This makes the implementation process easier. Furthermore, the management team has a clear vision about the implementation of the dashboard.

The managers are convinced that they can use the dashboard in the same way as they are used to with other dashboards. As explained before, the managers think that the dashboard is most useful when there is an overview of the results of the past 13 months available to be able to discover trends in the results. Furthermore, the dashboard must be useful for decisions at a tactical management level, which implies a term of 1 to 1.5 year.

It is preferred by the managers to analyse the results every month at the beginning, since it is a new tool, and once every two or three months later on. The results will be analysed during the management team meeting, which takes place every week. The Managing Director is the chairman of this meeting; the Ground Operations Managers North and South, the Ops Program Manager, the Ops Support Manager and the Ops COG & QCC Manager participate in the meeting (see Figure 3-3).

The managers expect that the analysis of the results will lead to many actions, especially in the beginning, since the dashboard creates an insight that was not there on a structural basis before. Furthermore, they expect that gaining experience with the dashboard will lead to the optimal use of the dashboard.

7.2 Consequences of the dashboard implementation

The consequences of the introduction of the dashboard are noticeable for the whole management team. However, the Managing Director and the Ground Operations Managers will experience the implementation the most. This section describes the opinion of these three persons on the introduction of the dashboard.

At the moment, the Managing Director and the Ground managers do not have any direct accountability for the utilization and flexibility of resources. However, the Managing Director is responsible for the condition of the whole system. The volume that is attracted to the Marketing & Sales department must be handled in one way or another; this is the responsibility of the Managing Director. This person is thus indirectly responsible for the utilization and flexibility of the resources. As explained before, the Managing Director will use this tool to raise the right questions for the Ground Managers and will not use the tool to manage the utilization and flexibility of resources himself.
The Ground Managers are accountable for achieving the costs target, the service performance target and a support to the EBIT (earnings before interest and taxes) score. It would be illogical to hold the Ground Managers directly responsible for the dashboard results, since this may lead to sub optimisation: using the resources well is only a sub objective, as explained before. The dashboard is a tool that supports the managers to achieve their final objectives. However, the Ground Operations managers will use the dashboard results to manage the capacity of the network (align the network size with the volume that must be handled), taking into account the minimal network size to guarantee the desirable service level.

7.3 Dashboard ownership

The previous sections of this chapter showed that the dashboard fits into the organisational culture of the organisation. Furthermore, it showed the consequences of the introduction of the dashboard. Another aspect of the real embedding of the dashboard is the designation of a dashboard owner. It is recommended to keep one person responsible for the dashboard in order to get the tool used in the future. As explained before, the managers agreed on the fact that the management team meeting is the most suitable meeting to discuss the results of the dashboard. The Managing Director is asked to be the dashboard owner for several reasons. First, this person is in charge of the management team meeting and is ideal to fulfil the role of dashboard owner, since he prepares the agenda for the management team meeting. Second, the Managing Director is ultimately responsible for all management team members and the dashboard therefore has a clear added value for him, as explained in the section 0. The Managing Director has agreed upon the dashboard ownership and he will let the dashboard appear on the agenda every month in the beginning and every two or three months if the dashboard usage is not new anymore.

7.4 Dashboard maintenance

Next to the dashboard ownership, the dashboard needs to be maintained, (this is also the final step in the approach of the sequential dashboard process, see section 2.3) In the first place, the dashboard must be refreshed every month for the discussion of the results. Furthermore, the dashboard must be updated in case the situation is changing. For example, the mix of products will be different, a sorter is renewed or the sorter window will be changed. Nevertheless, major changes can take place as well, for example when a terminal is closed or when it is decided that an extra KPI is needed to express the utilization and flexibility of resources.

The Managing Director is not going to update the dashboard monthly. He has assigned the dashboard maintenance to one of the management team members. The responsible person for the dashboard maintenance has become the Operations Programs Manager. Within this team, the dashboard maintenance is assigned to one specific employee: the Project Manager Equipment. The Project Manager Equipment is informed about several aspects of the dashboard:

- Who wants to have what information?
- When is the information needed?
- What are the dashboard source documents?
- How must the dashboard be updated?
- What is the accuracy of the data?
- On what location should the dashboard results be saved?

The information about the answers on these questions and other information is saved on the Operations directory. Examples of the raw data documents and the dashboards (current and future situation) are saved at this location as well.
7.5 Dashboard's feedback

It is important to understand why and how people are motivated for their job for the employer as well as for the employee. Two theories that explain why a person is motivated are the expectancy-theory and the goal setting theory. They both assume a person to have certain values that one would like to strive for and to achieve.

The goal setting approach goes more into depth about a set of statements that describe what requirements goals must meet in order to be in motivation for action and performance. One of these statements is formulated as follows: "There must be a regularly feedback moment which shows to what extent the goal is achieved at the moment. Targets and interim results are important to support the targets." (Ten Horn, 1995)

It is important that the dashboard itself gives the feedback that the users need to keep committed to the tool as it proves that the tool is useful to support the decisions on the medium term.

For this reason, a logbook function is built in the dashboard. In this simple logbook, the Ground Operation Managers can register their measures. The effect of this measure will probably be visible on the medium long term since it is for tactical decisions. However, the managers can register when they take a certain measure and can use these registrations to derive the effect of the measure by analysing the results over a longer period. Furthermore, the Managing Director can monitor what kind of measures the two Ground Operations Managers implemented. Finally, the dashboard functions as a memory as well, since the logbook makes it able to reread the measures. This final benefit is also useful when one of the managers succeeds.

This kind of logbook functions is already in use at DHL, for example in the weekly analysis at a terminal level. The following data fields are used for this logbook function:

- Status action
- Action number
- Action description
- Start date
- Due date
- Baseline – KPI
- Baseline – unit
- Impact – unit
- Impact – Investment (Euro)
- Impact – cost savings (Euro)
- Responsible person
- Support person
- Status description

The data fields for the resource utilization and flexibility dashboard are based on the data field above. The exact data fields of the utilization and flexibility dashboard are discussed in Chapter 9, which is about the construction of the dashboard.

7.6 Conclusions dashboard embedding

The embedding of the dashboard into the organisation is tried to achieve in several ways. The first positive point is that DHL Express already works with dashboards and scorecards and that this means that the dashboard fits into the organisation.

The dashboard is not like the other dashboards and scorecards, since this one is not meant to reward or punish employees for good or bad results. Optimisation of resource usage is not the final goals and optimising this aspect would probably lead to sub optimisation. However, the tool
is used to raise the right questions and start the discussion about the utilization and flexibility of resources.
The Managing Director fulfils the role of dashboard owner. This person is suitable to perform this task, since he is the chairman of the management team meeting and he is responsible for the condition of the Day Definite network.
The maintenance of the dashboard is assigned to the Project Manager Equipment who is a team member of the Operations Programs Manager. This person is responsible for the refresh and adjustment activities of the dashboard. The information transfer to this person concerned information about the mechanism of the dashboard, the raw data documents and the refresh activities. The necessary documents are saved at the Operations directory of the server.

The logbook function of the dashboard is useful from a motivation point of view. It enable the Ground Operations Managers to enter and monitor their taken measures and the consequences of those measures, it enables the Managing Director to monitor the influence of the measures from aside and it functions as a memory, which is especially useful if one of the managers succeeds.
Phase 4 – Dashboard Design

In the previous phases is described what kind of performance indicators must be showed at the dashboard and how the dashboard usage in the future is organised. This phase goes into more depth about the dashboard itself. It starts with a chapter about the KPIs that are displayed on the dashboard. The second chapter of this phase is about the construction of the dashboard, followed by a chapter about the verification and validation of the dashboard. The phase ends with a chapter about running scenarios, which is introduced to be able to view the dashboard results for different future situations.
8 Definitions of key performance indicators

This chapter is completely removed because of confidentiality.
The chapter can be requested at Erik van Tol (DHL Express NL)
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9 Dashboard construction

This chapter is about the dashboard and explains several aspects of the dashboard. The aim of the dashboard, as mentioned in Chapter 2, is to show the performance of resource utilization and flexibility in order to support the management team on medium long term decisions.

The chapter starts with a summation of the requirements of the dashboard, set by the management team. Second, the software that is used to construct the dashboard and the data flow are explained. Third, the structure of the dashboard is clarified. Finally, this chapter elaborates on the raw data that is used as input for the dashboard.

9.1 Requirements of the dashboard

Requirements are necessary to reach the aim of the dashboard. These requirements partly originate from the feedback sessions with the Operations management team, since these managers are the end users of the dashboard.
General requirements: (Sterrer-Pichler, 2010)

- The dashboard structure must be intuitive: easy to understand
- The dashboard must be flexible: it must be easy to adapt the dashboard to changes in the amount of terminals or KPIs
- The dashboard should be ergonomic: the desired information must be visible in a few mouse clicks

Requirements from the Operation managers:

- The dashboard must be updated monthly, which means that the refresh action must not be too extensive
- The dashboard must give an overview of the values of all terminals for a certain KPI
- The dashboard must be usable for two management levels (the upper and lower management level, explained in Chapter 3)
- The dashboard must give an overview of the previous 12 months and the current month to be able to analyse the trend on a certain KPI
- The dashboard must use objective and pure data as much as possible, since this will give the most realistic view on the situation and thus on the performance
- The software used to construct the dashboard must align with the available software tools at DHL Express.

9.2 Dashboard software

One of the requirements is about the software that is used to construct the dashboard: it must align with the available software tools at DHL Express NL.

Dashboards can be made with special software tools, especially meant for designing dashboards. However, none of these software tools is available at DHL Express NL. For this reason another program must be chosen.

At the moment, DHL Express already uses a lot of scorecards, dashboards and reports as explained earlier. Most of the dashboards only use one kind of source document and it is possible to directly upload the data in the dashboard. These dashboards are all built in Microsoft Excel.

This dashboard is using data from several source documents, as it is explained in one of the next sections. Besides, the files, which are downloaded from the software that are registering all those data, are very large. For these reasons the data is first uploaded into another software tool to prepare the data for usage in the dashboard.

Figure 9-2 shows a data flow diagram of the data from registration to input for the dashboard. Information about the input documents (volume data, route data, non-route data, HR data and fleet data) is provided in one of the next sections. The dashboard itself is explained in the next section.

The software tool that is used to prepare the data is Microsoft Access. It is also used to prepare data in other, more complex, dashboards at DHL Express. Furthermore, it is part of a standard Office package that is installed on the computers of DHL Express or at least, it is simple to obtain the Access via the Helpdesk of DHL.

When the data is prepared for dashboard usage, the data is uploaded into the dashboard. The dashboard is built with Microsoft Excel, like all other dashboards and scorecards. The employees are thus used to use Excel dashboards and scorecards. Furthermore, the same reasons as the usage of Access are applicable in this case: Microsoft Excel is approachable software and is installable on every computer at DHL Express.
9.3 Dashboard structure

This section is about the dashboard Excel file. The dashboard consists of several parts. These parts are:

- Data part (yellow tabs)
- Calculation part (grey tabs)
- Overview part (red tabs)

Each part consists of several sheets. This section shows the overviews of the dashboards. The data part and the calculation part are subordinated to the overview sheets and are thus described into more detail in Appendix 0.
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The overview part consists of four overviews:

- A main sheet for an overview of the KPIs on a country level
- A KPI overview sheet, which shows the values of a KPI for all Dutch terminals that handle DD pieces
- A terminal overview sheet, which shows the values of all KPIs for a certain terminal.
- An unnecessary resource costs sheet, that presents the unnecessary costs because of idle resources

The dashboard is useful for the whole management team, but as explained before, the Managing Director and the Ground Operations managers will use the dashboard most probably.

The Managing Director is primarily interested in the value for The Netherlands and values for the whole system, while the Ground Operations Managers are primarily interested in the KPI values of the individual terminals. That is the reason why the dashboard contains several overview sheets.

**Main sheet**

The data on the main sheet is the data with the highest level of aggregation and is thus especially useful for the upper management level. The main sheet is divided into four blocks and there are mostly two sections (utilization and flexibility) within a block. The blocks consist of the three resource categories (personnel, vehicles, buildings) and a system category. The main sheet is shown in Figure 9-4.

Regarding the resource category blocks, the sheet shows three numbers per KPI: a weighted average value of all terminals (= the value for The Netherlands), the value of the terminal with the lowest value and the value of the terminal with the highest value. Furthermore, the green zone is displayed in the right of the actual value.

Regarding the system block, the KPIs are built up of three values: the percentage of terminals that are in the green zone and the same for the percentage of terminals in the orange and red zone.

The colored zones make value judgments about the performance of a certain KPI. These zones are defined by norm values (also: targets). Those norm values determine whether a KPI value is within the desired range, almost within the desired range or far from the desired range. The target system is built up of fives zones and is presented in Figure 9-3.

**Figure 9-3 Norm value system**

The four system KPIs are considered to be the most important overall KPIs to express the utilization and flexibility of resources at a system level. Two of these KPIs are from the resource category personnel, since this was considered to be the most important category with respect to utilization and flexibility. (see Chapter 8) These KPIs are the ‘driving hours of total paid hours’ and ‘extra worked hours vs. contract hours’. The other system KPIs are the utilization of the terminal floor GRG Inbound and the C-license drivers vs. C-license vehicles. These KPIs are chosen by the managers since these KPIs are considered to be the bottlenecks of the future. The system KPIs are presented differently: these KPIs indicate how many terminals do have a desired score, an almost desired score or an undesired score.

**Figure 9-4 Main sheet of the dashboard**
**KPI overview sheet**
This sheet shows the values of a certain KPI for all terminals and it is especially useful for the Ground Operations Managers because of the lower level of aggregation. However, if the Managing Director is interested in the exact values of the terminals for a certain KPI, this person can use the KPI overview as well. The overview contains two parts: an overview for the KPIs and an overview for the factors (development personnel downsize flexibility and average tours per vehicle) to be able to see the relation between a KPI and the second level factor. Furthermore, the overview of a KPI is split into two parts: the terminals belonging to the Northern area of The Netherlands and the terminals belonging to the Southern area of The Netherlands. The user can choose which KPI is displayed on this overview. This protects the user against an inconvenient overview. The KPI overview is shown in Figure 9-5.

**Terminal overview sheet**
This sheet shows the values the KPIs for a certain terminal and it is especially useful for the Ground Operations Managers because of the lower level of aggregation. The Managing Director is in the first place probably not interested in this overview. Nevertheless, it can be useful to monitor a certain terminal when some major changes took place in this terminal for example. The layout of this overview is similar to the main sheet overview, except for the system KPIs of course. Another difference is that the terminal overview only shows an average value and does not show an overview on a lower level of aggregation, for example a minimum and maximum day-value in a month. This more detailed overview can be retrieved at the terminals when necessary. The terminal overview is shown in Figure 9-6.

**Unnecessary resource costs sheet**
The unnecessary resource costs sheet presents the fixed costs of the idle resources, which means that these costs are made, but that there is no revenue from having these resources. The fixed costs of the resource types are showed in Chapter 8. This sheet executes simple calculations to estimate the unnecessary costs for the current usage of resources. Only KPIs of the utilization category can be used to calculate the unnecessary costs. Below the KPIs that are used to calculate these costs are listed.

**Category: Personnel**
- The KPI driving hours of total paid hours is used to express the unnecessary costs, since this KPI indicates whether the paid hours are deployed in a useful way.

**Category: Vehicles**
- The KPI utilization # DHL vehicles is used to express the unnecessary costs, since this KPI calculates on average, how many vehicles are unused. Unused vehicles costs money and do not generate revenue.

**Category: Buildings**
- The KPI utilization terminal floor GRG Inbound is used to express the unnecessary costs, since this KPI indicates which part of the terminal surface is unused. If the unused part is very large, the terminal could have been smaller and that would have led to lower fixed costs. The unit of this calculation is m².
- The KPI utilization sorter is used to express the unnecessary costs of the sorter. Sorters are very expensive using only a very small part of the capacity would thus mean that there may be other cheaper methods to sort the parcels.

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The unnecessary costs are not calculated for a 100% score, but as the difference between the actual amount of used resources and the lowest value of the green zone. For example:

- **Capacity:** 10 vehicles
- **Green zone:** between 8 and 10 vehicles
- **Actual usage:** 6 vehicles
- **Costs per vehicle:** 800 Euro.
- **The result of the unnecessary costs is** \((8-6)\times800 = 1600\) Euro.

### 9.4 Raw data and the accuracy of raw data

The KPI values are calculated by means of raw data. The data used for these KPIs originates from several databases. The four databases are:

- **Human resource (HR) data (from SAP).** The information about the contracts of employees is provided by the HR department. SAP is business management software for companies of all sizes. The data can be provided in Excel or in Access. The file can be requested at the HR department every month.
- **Fleet data (vehicle specifications).** The fleet data is provided by the Operations Support Manager. The information is updated every month. It is thus possible to update this information on a monthly basis.
- **Hour registration.** The hours registration contains two source documents:
  - Tour hours. In this database, data about the tours of drivers are registered. Every day the hours are entered into the database of the Labour Reporting Tool (LRT).
  - Other hours (illness, training, support activities, etc). These hours are also entered in LRT. However, this data is saved at another database.
- **Volume data (amount of parcels, pallets and non-conveyables).** This information is registered at a terminal level and at a country level. The type of information is not the same: the decentralized database stores the data about the unique amount of pieces while the central database stores the data of all scanned pieces. Appendix L shows an overview of the data fields that are retrieved from the different sources.

An issue that almost always plays an important role when data is used, is the accuracy of the raw data. In this case, the level of accuracy is different for the raw data files. First of all a short overview of the accuracy of each source document is given under normal conditions. Second, two inaccuracy issues are discussed.

#### Accuracy of the source documents

As explained in the previous section, there are four different sources, one of which has two different data files. This section goes into more depth about the general accuracy of those documents.

The HR data and the fleet data that is used for the calculations of the KPIs, is relatively accurate. These databases are kept up to date and in all probability, the information in the database filled out rightly. Of course, there can be some minor changes between the data at a terminal level and at a country level, but these changes will be minimal.

The information that is retrieved from the LRT is less accurate. The information of LRT is partly retrieved from some electronic devices like a hand terminal to scan the shipments at the delivery. This information is not always reliable, since there are many possibilities for employees to influence the data. Another part of the LRT data is manually filled out on a form by employees themselves. Afterwards, it is entered into the database by other employees. This process, two activities performed manually, can easily contain errors. (This can occur accidentally or on purpose)

The information about volume is reported every week. Via a mailing list, this information is sent to all relevant employees. These numbers originate from the sorter that counts how many parcels
are scanned during the process and registers at what time the parcels pass the scanner. The data about the amount of scans is practically 100% accurate.

**Inaccuracy issues**
The input data for the employees, fleet and volume seems to be accurate. However, there is a problem with the volume data. But first the main accuracy problem of the LRT database is explained.

*License plate registration*
The main problem of the LRT data is the license plate registration. It happens relatively often that the license plate is not filled out correctly or even illegible on the form. Furthermore, the process of entering the license plate into the database could go wrong as well, if the license plate is incorrect, illegible or if the data entry employees make mistakes. The license plate is of essential importance for the calculation of the KPIs, since the license plate number is the connection between the hour registration and the fleet list source data. If the license plate is incorrect, the calculation will contain mistakes and the results will be less accurate.
The error that occurs when the license plate is filled out incorrectly is that the vehicle is not recognised in the fleet list. This causes that the vehicle is assigned to be a hired vehicle instead of a DHL vehicle, which means that the utilization of DHL vehicles is affected.

*Unique amount of parcels*
The registered amount of scans is accurate, but it is not the amount of scanned parcels that are interesting for the calculations of the KPIs. The main problem with the volume data is that these numbers are registered amount of pieces and not the unique amount of pieces. This means that every piece that is scanned more than once will count for more than once. The goal is to scan every piece once, so it is recommended to use the unique amount of pieces for further calculations. Furthermore, this information is also used to calculate the necessary floor surface, vehicle surface, etc.
The information about the unique amount of parcel is available though, but only at a terminal level and not at a national level. Retrieving the unique amount of parcels from the decentralized databases would take much time each month, since this download process takes a lot of time and it must be done for 14 terminals and two processes per terminal per day (Inbound process and outbound process). It will probably takes an employee almost a day to retrieve all those records.
For this reason, it is decided to use the central stored records that contains an error. The paragraphs below show the size of the error and the consequences of this error.

### 9.5 Dashboard maintenance: refresh dashboard data

The previous sections explained the structure and content of the dashboard. This section explains which activities need to be done to refresh the dashboard data.
As explained earlier, the dashboard results always concern one month. The monthly results are presented in an overview of 13 months to discover trends. However, refreshing the dashboard needs to be done monthly.
One of the requirements of the dashboard is that the dashboard must be easy to maintain. The previous section already explained which data is necessary to retrieve from different databases. This section presents a short procedure that must be followed to update the dashboard:
1. Retrieve the data about the tours and the data about the other paid hours from LRT and save it as an Excel file.
2. Convert and combine the weekly reports about the volumes. This weekly file is automatically sent to the inbox if one is added to the mailing list.
3. Receive the HR data and fleet data from the HR department and the Operations Support manager respectively.

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4. Upload the data in Access
5. Run the queries in Access to process the raw data and convert it into the desired format
6. Refresh the dashboard in Excel. The pivot tables on the results sheet are automatically updated if the refresh button is pushed and the KPI values change too.

It is recommended to use whole working weeks to update the dashboard, since the KPI 'extra worked hours of contract hours' is calculated over the weekly average value. (the contract hour data is a fixed amount of hours per week) If the data set does not consist of full working weeks, the average worked hours per week are not calculated rightly.

The following rule may be used: a certain week belongs to the month whereby the majority of days of that week belong to. For example, the workweek of June the 28th to July the 2nd 2010 belong to June (3 days June, 2 days July) and the workweek of November the 29th to December the 3rd 2010 belong to the month December (2 days November, 3 days December).

Step 5 of the procedure is to run all the queries that convert the raw data input into the right input data for the dashboard. The conversion is done by means of formulas. These formulas can all be found in Appendix M.

These five processed raw data files are also used to create some extracts of those files, for example an extract of the unique vehicles (to have an overview of how many vehicles are used on one day). These extracts use exactly the same data, so an overview of these data files is not added to the report, as it shows no new formulas.

9.6 Other dashboard applications

The dashboard is especially designed for DHL Express NL for the problem of resource utilization and flexibility. However, this dashboard may also be used for other applications.

First of all, it is easy to use the dashboard in foreign DHL companies as well. The dashboard is in English, thus there is no linguistic barrier. The dashboard uses data that is used in other countries as well. All other DHL regions work with LRT, which means that the data about the route and the non-route hours can be retrieved from the system. Furthermore, every region has information available about the employees and about the fleet, so this will not be a problem either. Besides, every region register the amount of volume that is handled at the terminals. These source documents are sufficient to use the dashboard in other countries as well.

Second, the dashboard would be useful for every company that is similar to DHL from a resource perspective. The dashboard is most useful when the company has many resources and when flexibility of resources is desired and possible. For example, the dashboard may not very useful for a company that completely exists of fixed resources. These resources can hardly be managed in that case. Concluding, a certain degree of resource flexibility is required.

A notable remark that must be made is that the dashboard require much information. DHL registers a lot of information, which makes it possible to calculated everything in detail. Probably not every company register that much. A limiting condition of the dashboard is thus that it a lot of raw data requires.

9.7 Conclusions dashboard construction

The constructed dashboard is built in Microsoft Excel. The raw data documents are retrieved from different servers and provided by other DHL Express employees. The raw data is processed in Access and uploaded into the dashboard file.

The dashboard consists of three parts: the data part, the calculation part and the overview part. The norm values for the KPIs, which belong to the data part, make it possible to judge the result value of a KPI. The different overview sheets make the dashboard suitable for the Managing Director as well as for the other management team members.
The accuracy of the raw data varies: some data is really accurate, but some data fields are not very accurate. The two main problems that are encountered with respect to the accuracy of raw data are the registration of license plates and the counting the amount of unique parcels. The error of the first problem is between the $B^\text{W}P^\text{°}$ and $B^\text{°}$ and has an administrative nature and could therefore be improved relatively easy. The error of the second problem is between the $8\%$ and $1\%$ and has an information system nature. This problem is more difficult to solve: cooperation between Operations and IT is necessary to solve this problem.

Finally, the dashboard can be applied to other DHL regions as well. The required data is provided in every region; that will not be a problem. Furthermore, the dashboard is also applicable to company that are similar to DHL from a resource point of view: many resources and flexibility to a certain extent. The dashboard would be useful for those companies as well. One remark that must be made is that the dashboard requires a lot of data. A company that does not register all the things that are used for the dashboard cannot use the dashboard either.
10 Dashboard verification and validation

The terminology of verification and validation is unambiguous. In computer science literature, verification is defined as the check on consistency, while the validation is defined as the check on usability. The same terminology is used by the Faculty of Technology, Policy and Management of the Delft University of Technology. (Van Daalen & Thijssen, 2005) For this reason, this terminology is used for this project as well.

10.1 Dashboard verification

This section is about the verification of the model. The verification is done by checking all the requirements of the dashboard, as stated in section 9.1. The requirements consist of three general requirements and six requirements defined by the DHL Operations management team.

10.1.1 General requirements

The first general requirement is about the intuitivism of the dashboard: the dashboard must be easy to understand. This requirement is met, since the dashboard consists of three overviews that can be viewed to judge the utilization and flexibility performance of the DHL Express NL resources. These sheets do not contain enormous tables and dozens of numbers on a sheet. The main sheet and KPI overview (per terminal) contain 22 and 18 KPIs respectively and the KPI overview (per KPI) does contain the values of one KPI for all the 14 terminals. Due to the convenient arrangement, the sheets are understandable.

The second general requirement is about the flexibility: it must be easy to adapt the dashboard to changes in terminals and KPIs. This requirement is met as well, since it is easy to add a KPI or add a terminal. However, the dashboard is flexible to a certain extent, adding of removing a KPI is not much work, but it is not possible to add a KPI only at one place. Several acts are necessary to add or remove a KPI.

The third general requirement is about the ergonomics of the dashboard: it must be easy to view the desired data in a few mouse clicks. This requirement is met too, since a user can look up the data in the format one wants: an overview of all terminal values for one KPI, an overview of all KPIs for one terminal and an overview of a “The Netherlands value” for all KPIs and four system KPIs that show the network performance. The user does not have to make an overview himself before the desired results can be shown.

The other side of this ergonomic dashboard is the user's flexibility. It is not possible to customise the overviews to the user's own desires. However, the future users of this dashboard were already involved in an early stadium, which makes the chance on a mismatch between the functionality of the dashboard and the desired functionality of the users very small.

10.1.2 Additional requirements

In addition to the general requirements, there are also requirements defined by the end users of the dashboard: the management team of DHL Express NL. The first requirement is about the update time period. The dashboard must be able to be updated every month. This means that the refresh activity must be easy and not time-consuming. The dashboard needs five raw data reports from three different databases and a fleet overview report and a HR overview report, as explained in the previous chapter. However, in an hour (maximum) the dashboard can be fully updated (including the collection of the raw data), which means that this requirement is met.
The second additional requirement is about the overview of the values of all terminals for a certain KPI. This one is met as well as described before.

The third requirement is about the usefulness of the dashboard for two management levels. This requirement is met as well explained in Chapter 9. On the one hand, it would add extra value if the data behind the numbers could be shown on one more-detailed level of aggregation: the causes of a not-desired value cannot be found out in this dashboard, but must be found out at the concerned terminal or the user must use the result sheet for this activity, which is not ready for this purpose at the moment. On the other hand, this dashboard is developed to support the decision-making process at a tactical management level, which primarily does not require detailed information.

The fourth additional requirement is about a '13 months'-overview that not only shows the information of one month, but also the trend during the past year. The 13 months overview is made in a separate overview, since importing all the data in one excel file would make the dashboard very slow.

The dashboard must use objective and pure data as much as possible is the fifth additional requirement. This requirement is met, since it mainly uses raw data and objective data as terminal specific information. However, one big remark is the accuracy of the input data. The accuracy issue is discussed in the previous chapter. Next to the objective data, some assumptions are made, but almost all these assumptions are also used for other dashboards and scorecards, and are thus of a sufficient and accepted level.

The final additional requirement is that the software that is used to construct the dashboard must be aligned with the available software tools at DHL Express NL. This requirement is met, since the raw input data is processed in Access and the dashboard is constructed in Excel. The employees of the Operations department of DHL Express NL are familiar with these two software tools.

### 10.2 Dashboard validation

The validation of the dashboard is performed during the whole project, since this is necessary to come up with a dashboard that meets the DHL operation managers' expectations. This section is structured according to the project structure as presented in Chapter 2 and shown again in Figure 10-1.

In Chapter 6, the ways to create a basis of support are explained. Nevertheless, the activities to achieve support and commitment contributed to the validation of the dashboard. This section describes the validation of the dashboard's aspects by dividing this section into three parts: the conceptualization phase, the dashboard design phase and the results phase. The validation methods per phase are explained.
Validation process during the conceptualization phase
The conceptualization phase consists of information about the company DHL Express NL and about performance measurement in general and performance measurement at DHL Express NL. The information about the company DHL does not need any validation. The dashboard aspect that did need validation was the selection for performance categories, processes and resources. The validation of these activities is done by means of the conversations with the management team. The schemes presented in Chapter 4 are discussed during the conversations and adapted when necessary. Furthermore, the choices for the resources and the processes are also validated by asking the opinion of an Operations Manager at a terminal from an operational point of view and by asking the opinion of a business analyst operations control from an economic point of view.

Validation process during the dashboard design phase
The dashboard aspect that needed validation during the design phase was the KPIs. These KPIs must reflect what the managers want and need to know. The process of defining these KPIs is already described in Chapter 8.
The process started with the system analysis, process analysis and exploration of existing dashboards in order to create a long list of KPIs. This long list is reduced to a short list by a selection process of three DHL experts. Then, the short list was reduced to the first version of KPIs by conducting research to the most interesting aspects of resource utilization and flexibility performance measurement from an operational and financial point of view. The first version of KPIs was improved by an iterative improvement process during the feedback sessions with the Operations management team.
The contributions of the three Experts and the Operations management team resulted in KPI definitions, KPI calculations and a dashboard layout and functionality that are in accordance with the expectations of the managers.

Validation process during the results phase
The completion of the dashboard construction made it possible to analyse the results. Again, the feedback on the results took place during the feedback sessions with the managers. The results were checked by the managers based on their knowledge and on thoughts about the results. Nevertheless, they must keep in mind the accuracy problems of a part of the input data.
The first version of the dashboard was already used to validate the results and therefore the calculation validation and results validation took place at the same time. Finally, the results of the current situation are checked by the managers.

10.3 Conclusions dashboard verification and validation
The conclusions that can be drawn from the dashboard verification are that all the general requirements as well as the additional requirements are met. The only aspect that may be able to get more attention is the flexibility of the dashboard itself.

The conclusions that can be drawn from the validation process are that the choice of performance categories, resources and processes is performed well and that the future users of the dashboard are satisfied with the KPIs that are shown on the dashboard.
A remark is the accuracy of the input data, which leads to deviations in the results of the KPIs. However, these inaccuracies are known by the future dashboard users and the causes of these inaccuracies are known as well, which makes it possible to improve the quality of the input data.

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11 Dashboard usage for the future: running scenarios

The Operations management team has the desire to have insight into the performance of the KPIs in the medium long term. Running scenarios may give this insight. The idea of running scenarios is that the raw data is modified to simulate a possible future situation. This chapter explains the approach to use the dashboard as a scenario tool and clarifies the developed scenarios that are used to simulate possible future situations of DHL Express NL.

11.1 Scenario planning in literature

The term scenario is unambiguous and can be interpreted in many ways. In this project, scenarios refer to as "a description of possible actions or events in the future". (Cambridge Online Dictionary, 2010) In literature, many articles can be found about the way how to construct scenarios and scenario planning. Roughly, three schools of thought can be distinguished: Intuitive-logics models (from the USA), La Prospective models (from France) and probabilistic modified trend models, incorporating trend impact analysis and cross-impact analysis (also from the USA). (Bradfield, Wright, Burt, Cairns, & Van der Heijden, 2005)

However, these scenario planning methods go more in depth than that is necessary for this project, since it is not the core business of the project. Nevertheless, scenario planning is useful in times of uncertainty and scenario planning "simplifies the avalanche of data into a limited number of possible states." (Schoemaker, 1995) Furthermore, the article underlines that sensitivity analysis and scenario planning are different: "sensitivity analysis examines the effect of a change in one variable, keeping all the other variables constant", while scenarios "change several variables at a time, without keeping others constant." (Schoemaker, 1995)

This project uses a simple form of scenario planning, which means that several variables are varied at a time, while others are kept constant. The following sections will go into more depth about the goal of scenarios in this project and the way the scenarios are run.

11.2 Objectives and requirements of running scenarios

Running scenarios has two goals:

1. Function as a sensitivity analysis of the dashboard
2. Gain insight into the performance of the KPIs when the volume size will change in the future

The second objective is mainly useful with respect to the decisions at a tactical level. The 13 month overview of the actual dashboard results provides insight in the trends of the past year, but running scenarios provides insight in the situation in 1 to 1.5 years.

The requirements are formulated in cooperation with the Operations management team. They can be divided into obligatory and optional requirements. The scenarios must meet the requirements of the obligatory-requirements (the necessary requirements) and it would be nice if the scenarios could also meet the optional requirements.

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The obligatory requirements are:

- It must be possible to change the volume (amount of parcels, pallets and non-conveyables) and keep the system equal to observe the effect on the utilization and flexibility of the resources when the amount of pieces (=input) changes.
- It must be possible to vary the parameters "growth in the number of stops" and "growth in the number of pieces". These parameters are related to the duplication factor: in case the new pieces must be delivered at existing customers, the amount of stops will not grow, but the amount of pieces per stop will grow. This leads to an extra efficiency, since the amount of stops are leading for the time spent on the delivery process. In case the new pieces must be delivered at new customers, extra stops will be necessary to deliver all the shipments. However, the amount of pieces per stop will not grow by definition.
- It must be possible to vary the growth of every volume category separately (parcels, pallets and non-conveyables).

The optional requirements are:

- It would be nice to have scenarios whereby the system composition can be changed (e.g. close one terminal or add another terminal) and the amount of pieces could be equal in order to observe the impact on the utilization and flexibility of the resources when the system internally changes.
  The parameters that can be changed in this case are the terminal that must be closed or the location where a terminal could be added. However, this requires totally different scenarios than the ones that must be created for the obligatory requirements, since it makes the scenarios much more complex.
- A second option would be a scenario whereby the volume as well as the input can be changed. This also would require very advanced, but interesting scenarios as well.

### 11.3 Approach to obtain scenarios

Originally, the idea was to run scenarios based on the raw data as used for the dashboard described in Chapter 9. However, the dashboard uses five different source documents to calculate the KPI values. Three of the documents include data about the amount of pieces that are delivered and picked up and about the amount and the duration that the resources are used to execute the processes. The data in the source documents originate from different registrations: some are registered automatically and some manually. Furthermore, the data is included in different units. For example, in one source document, the volume is registered in total amount of pieces, while in another document the volume is registered, specified on volume category. Finally, the total amount of pieces of the different documents is not totally equal, which makes it more difficult to use the real current data as a starting point for simulations. These reasons led to the choice to use simple calculations that simulate the actual raw data.

In order to keep the calculations simple, the dashboard raw data files is reduced to one file that contains information about volume. The file about volume data only is found to be the most suitable source document, since it contains information about the amount of pieces per volume type and thus specified volume information. The documents that contain information about the amount of hours and vehicles that are used are left out of scope for the raw data calculations for the scenarios. Instead, the amount of vehicles and hours that must be used to deliver all the pieces is calculated based on some assumptions and numbers from reality. Figure 11-1 and Figure 11-2 show the initial and final idea about the approach respectively.
The figures above show that scenarios require two extra types of information: the scenario parameters and the formulas to calculate the used vehicles and personnel hours, since these do not originate from the operational data anymore.

Obtaining a data set that is suitable to run scenarios can be achieved in three steps:

1. Think of a mechanism that can be used to simulate the real process properly in terms of vehicle and personnel usage
2. List the parameters that are necessary and desirable to include in the scenario tool, based on this mechanism
3. Make new formulas that include the parameters and can calculate the new data set

If these three activities are done, the new data set can be used to update the dashboard. This leads to an insight in the performance of the KPIs in the medium long term, according to a certain scenario. However, it is of no use to calculate all KPIs for the scenarios, since the performance of some KPIs do not depend on the volume size. The interesting KPIs are described later on. The following sections explain the mechanism, the parameters, the selection of useful KPIs and the defined scenarios.

### 11.4 Mechanism to obtain scenario data set

Before the creation of the scenario dashboard started, the requirements were overlooked. It was decided to only take into account the obligatory requirements and not the optional requirements, since taking into account these requirements also means starting a complex building process and the time to build this other kind of scenario tool is limited. Furthermore, the nice-to-have requirements are out of scope of this project as well.

**Mechanism to deploy vehicles and employees**

In general, the following figure represents what procedure is followed when the amount of volume or the forecast about the amount of volume is known. The amount of volume as well as
the length of the working day and the duration of activities of the delivery process, determines how many vehicles are needed to deliver all the shipments. The amount of used vehicles determines how many employees must be deployed and how many working hours are needed to deliver all the shipments.

From Figure 11-3 can be concluded that the amount of deployed vehicles and employees changes when the volume size (significantly) changes. There are two possibilities: the volume increases or decreases. Figure 11-4 shows what decisions must be made when the volume size changes and it shows the effect on the KPIs.

A volume change for delivery automatically influences the utilization of the terminal floor GRG IB and the utilization of the sorter during the Inbound process. Furthermore, the load factor is influenced. In case it is decided to change the amount of deployed vehicles, the utilization of the terminal doors will change as well. The load factor and the amount of used vehicles influence the KPI volume size vs deployed vehicle floor surface of the GRG vehicles. The choice between a DHL vehicle, a rental vehicle and subcontractor vehicle must be made. This decision influences the pieces delivered by non-DHL vehicles and the utilization of the amount of DHL vehicles.

The next decisions that must be made are about the personnel. When the amount of DHL drivers changes, the KPI driving hours vs total paid hours, extra worked hours vs contract hours and the pieces delivered by non-DHL drivers are changing. When the amount of non-DHL drivers changes, the pieces delivered by non-DHL drivers will change as well.
Delivery volume change

Action?

Changed utilization terminal floor GRG

Changed utilization sorter inbound

Changed average hours per vehicle

Changed volume size vs vehicle floor surface

Change amount of drivers

DHL driver?

Changed amount of DHL drivers used

Changed driving hours vs total paid hours

Changed extra worked hours vs contract hours

Changed amount of non-DHL drivers used

Changed pieces delivered by non-DHL employees

Changed amount of DHL vehicles

Changed utilization DHL vehicles

DHL vehicle?

Changed amount of non-DHL vehicles

Changed pieces delivered by non-DHL vehicles
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Simplifications for the deployment mechanism of vehicles and employees

The just described method to take operational decisions about the deployment of vehicles and personnel is a sophisticated process that is difficult to simulate with a simple Excel document. For this reason, some simplifications are implemented to make a simple model to predict a future situation.

Rules that are applied to simplify the calculations with respect to the amount of vehicles are listed below.

- When DHL vehicles as well as non-DHL vehicles are used:
  - In case of increasing volumes: extend the amount of non-DHL vehicles
  - In case of decreasing volumes: reduce the amount of non-DHL vehicles to zero, before the amount of used DHL vehicles is reduced

- When only DHL vehicles are used:
  - In case of increasing volumes: deploy all DHL vehicles first, before third party vehicles are rented
  - In case of decreasing volumes: keep the amount of non-DHL vehicles to 0 and reduce the amount of used DHL vehicles.

The actual situation is a bit different: it is possible that non-DHL vehicles are used while DHL vehicles are not used. Reasons for this are broken vehicles and contracts with third companies that take care of the delivery in a certain area. Consequences of these simplifications are that the amounts of used DHL vehicles and used non-DHL vehicles are slightly different in the actual situation.

Rules that are applied to simplify the calculations with respect to the amount of worked and paid hours are:

- The deployment of employees is calculated based on the used vehicles, since every vehicle simply needs a driver.
- The amount of working hours is based on the amount of pieces per vehicle and the corresponding amount of stops. The total working time per driver is multiplied by the amount of used vehicles per terminal (distinguished between DHL and non-DHL vehicles). This calculation results in the total amount of working hours needed to deliver all the shipments.
- An assumption is made that all DHL vehicles are driven by a DHL employee and all non-DHL vehicles are driven by a non-DHL employee.

Next to the working hours, the drivers make non-route hours. For example when a driver performs some support tasks or when a driver is on holiday. Those hours are calculated as a percentage of the route hours, since this number is impossible to calculate from the volume data only. The working hours and non-route hours together form the total paid hours for a certain amount of volume.

11.5 Parameters and formulas to calculate the scenario performance

This section is about the second and third step of the approach as explained in section 11.3. The parameters are the variables that are varied to obtain different scenarios. The desired parameters are already presented in the requirements. These parameters and their descriptions are listed in Table 11-1.
### Table 11-1 Scenario dashboard parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume factor parcels (Inbound)</td>
<td>Volume change</td>
</tr>
<tr>
<td>Volume factor parcels (Outbound)</td>
<td>A value of 1 means no change</td>
</tr>
<tr>
<td>Volume factor non-conveyables</td>
<td>A value of 1.2 means +20% volume</td>
</tr>
<tr>
<td>Volume factor pallets</td>
<td>A value of 0.9 means -10% volume</td>
</tr>
<tr>
<td>Average tours per vehicle (DHL)</td>
<td>The average amount of tours that is done</td>
</tr>
<tr>
<td></td>
<td>by a driver on one day</td>
</tr>
<tr>
<td>Average tours per vehicle (non-DHL)</td>
<td>Efficiency factor. 1 =&gt; no extra efficiency.</td>
</tr>
<tr>
<td>Change factor amount of pieces per stop KLG</td>
<td>1.05 =&gt; 5% extra efficiency.</td>
</tr>
<tr>
<td>Change factor amount of pieces per stop GRG</td>
<td></td>
</tr>
</tbody>
</table>

The calculations that must be made, must use assumptions to simulate the actual situation, since not all the necessary raw data can be used. The numbers used for these assumptions are called coefficients. Some of the assumptions are derived from historical data, while other assumptions are thought by the Operations management team. All the values of those coefficients are presented in Appendix 0. The calculations that are used to obtain the new data set that is suitable to run scenarios are also presented in Appendix 0.

### 11.6 Useful dashboard KPIs

The previous sections roughly made clear how the vehicle and employee deployment are calculated. The results of those calculations are necessary to calculate the KPI values. Nevertheless, it is impossible or meaningless to calculate all the KPIs with this scenario dashboard, since not all the data is present and since some assumptions are made. This section discusses the usefulness of the KPIs per category

#### KPIs of the category personnel

Three KPIs of this category are (mainly) independent of the volume size and thus do not need to be calculated by means of scenarios. These KPIs are the on tour hours of total working time, the potential personnel downsize flexibility and the C-license drivers vs C-license vehicles. The KPI driving hours of total paid hours is dependent on the volume as shown in Figure 11-4, but the KPI cannot be calculated, since the non-route hours cannot be calculated without many assumptions. The KPIs on personnel that still remain meaningful and useful are the KPIs about the extra worked hours versus the contract hours and the KPI about the percentage of delivered pieces by non-DHL employees. Those two cover the utilization and flexibility of personnel for scenario usage sufficiently.

#### KPIs of the category vehicles

One important assumption that is made on vehicle usage is that the average tours per GRG vehicle is 1.3, since this is the desired value for the Operations management team. An assumption about the average tours of the GRG vehicles is inevitable, since the amount of needed vehicles may not be calculated otherwise. This assumption makes the calculation of the average tours per GRG vehicle meaningless. Furthermore, the KPI about the volume size in m³ versus the floor space of all deployed GRG vehicles is useless to calculate, since this percentage will always be up to 130%. Mostly it will be a bit less than 130%, because the amount of needed vehicles is always rounded up of course. The KPIs that are left, the utilization of the DHL vehicles and the pieces delivered by non-DHL vehicles, remain important and representative for the utilization and flexibility of the fleet in the future.

One important remark must be made on the utilization of the fleet. For the current situation the fleet utilization was calculated by including the usage of the vehicles during the day and during...
the night. This dashboard works with a different definition: it only includes the vehicle usage during the PuD process.

**KPIs of the category buildings**
This category is the easiest one: all KPIs of this category remain important. These KPIs can be calculated directly from the volume data: the scenario parameters and the raw data about volumes is enough. The utilization of the terminal doors can be calculated by using the, already calculated, amount of deployed vehicles.

**KPIs on the category system**
As a consequence of the selection of useful KPIs of the three categories, the system category only can use two KPIs that remain useful: the terminal floor utilization GRG vehicles and the flexible worked hours versus the contract hours.

Below, all the KPIs that remain interesting to calculate for the future are listed below.

- Extra worked hours vs. the contract hours (at a terminal level and at a system level)
- Pieces delivered by non-DHL employees
- Utilization of the fleet (KLG and GRG, for PuD only!)
- Pieces delivered by non-DHL vehicles
- Utilization # terminal doors
- Terminal floor utilization GRG vehicles IB (at a terminal level and at a system level)
- Utilization sorter (Inbound and Outbound)

**11.7 Appropriate scenarios for the medium term**

The previous sections explained the three steps to prepare a new data set to run the scenarios. This section goes more in depth about the scenarios that are tested.

First of all the term medium term in relation to the scenario dashboard must be clear. With the medium term is meant a period of 1 to 1.5 year. The scenarios thus represent the different situations which might occur in 1 to 1.5 year.

The different scenarios are created in consultation with the Operations management team. The must-have requirements already stated which parameters must be able to vary for the different scenarios. At the moment, the Operations management team is interested in two kinds of scenarios: a scenario with a decreasing amount of volume and a scenario with an increasing amount of volume. Both scenarios are described below.

**Scenario with a decreasing amount of volume**

At the moment, the amount of volume is relatively low, compared to the situation of two years ago. However, the managers would like to see the impact on the utilization and flexibility of resources if the volume decreases even further. According to them, a decrease of 10% compared to the current volumes is a realistic, but really undesired, situation.

A decrease of 10% is used for the volume factor of all volume types (parcels Inbound, parcels Outbound, non-conveyables Inbound, pallets Inbound). The average amount of tours per vehicles remains 1.3 tours per vehicle. Furthermore, the efficiency factor for pieces per stop is 1, which means that there is no extra efficiency in the amount of stops.

In short, the scenario of a volume decrease of 10% looks like the following:

- Volume factor = 0.9 (or all volume factors)
- Average tours per GRG vehicle = 1.3
- Change factor for amount of pieces per stop = 1 (for both KLG and GRG)
**Scenario with an increasing amount of volume**

Another likely scenario is that the volume size will increase the next 1 to 1.5 year. It is expected by the Operations management team that an increase of 20% for all volume types is realistic. Furthermore, this scenario is preferred to be the future situation of course and the intensive cooperation between Sales and Operations has been established to achieve this 20% volume increase.

This positive scenario can be varied with another parameter: the change factor of the amount of pieces per stop, which indicate the extra efficiency that can be made if the extra volume must be delivered to existing addresses. The different sub scenarios are presented below.

Sub scenario 20% growth in volume and no extra efficiency in pieces per stop
- Volume factor = 1.2 (for all volume factors)
- Average tours per GRG vehicle = 1.3
- Change factor for amount of pieces per stop = 1 (for both KLG and GRG)

Sub scenario 20% growth in volume and 5% extra efficiency in pieces per stop
- Volume factor = 1.2 (for all volume factors)
- Average tours per GRG vehicle = 1.3
- Change factor for amount of pieces per stop = 1.05 (for both KLG and GRG)

Sub scenario 20% growth in volume and 10% extra efficiency in pieces per stop
- Volume factor = 1.2 (for all volume factors)
- Average tours per GRG vehicle = 1.3
- Change factor for amount of pieces per stop = 1.10 (for both KLG and GRG)

**Running scenarios**

The scenarios that are developed can be runned and the results can be analysed. However, section 11.3 explained that a different data set must be used to include the parameters of the scenarios and section 11.6 clarified that not all KPIs are relevant to show on the dashboard. Therefore, it is decided to create a new file, with the same dashboard, but with a different calculation sheet to prepare the new data set. The KPIs that are not used for the scenarios are displayed in grey.

**11.8 Scenario verification**

At the beginning of the chapter, two types of scenario functionality requirements are presented. This section discusses whether the requirements are met.

All obligatory requirements are met, since the dashboard can vary the volume and the amount of pieces per stop. The optional requirements are not met, since these requirements are very time consuming and out of scope of the project. It is interesting though to set up a scenario data set and calculations that are able to meet the optional requirements as well.

The validation of running scenarios reflects whether the future dashboard users are satisfied or not. The scenario meets the management team’s expectations. The validation of the scenarios is done by organising the feedback sessions. The final meetings were mainly about the scenarios. They are satisfied with the dashboard and recognize the added value. The added value exists of the ability to look at the performance of resource utilization and flexibility of possible situations that may occur in 1 to 1.5 years.

However, simplifications were inevitable to prepare a data set for scenarios because of the raw data problem. These simplifications are agreed upon by the Operations management team, since they were necessary to construct the scenario data set.
11.9 Conclusions and recommendations about the scenario dashboard

Two goals about running scenarios are formulated at the beginning of the chapter:

1. Function as a sensitivity analysis of the dashboard
2. Gain insight into the performance of the KPIs when the volume size will change in the future.

The conclusion concerning the first objective is that running scenarios can function as a sensitivity model of the dashboard and thus that the goal is achieved. The scenario data set contain parameters that can be varied. If the volume parameter is 1, the current situation is simulated. A decrease or increase in volume is simulated, if the volume parameter is respectively lower or higher than 1. The results of the scenarios are discussed in the next phase, but it can be concluded that the approach of running scenarios is useful to test the sensitivity of the dashboard.

The conclusion concerning the second objective is that running the scenarios provides insight into the performance on resource utilization and flexibility in the future. The parameters and calculations were necessary to create a new data set which is able to simulate different scenarios. These scenarios can be runned by updating the dashboard and using this data set. The calculations use coefficients that are estimated by using historical data of one month or one year and by the Operations management team. The values of the coefficients are thus based on assumptions. At the moment, the accuracy of the coefficients is sufficient, but these may be further improved by extra research.

The scenarios are runned in a different file, but with the same dashboard. The results sheet is replaced by another results sheet, which contains the calculations of the new data set. The KPIs that were not interesting are displayed in grey on the overview sheets.
Phase 5 - Results

The previous phase was about the construction of the dashboard and the scenarios. This phase describes the results of the dashboard. The results of the current situation are presented in Chapter 12 and are based on data from November the 1st to November the 27th. The results of the scenarios are presented in Chapter 13 and are based on the scenarios as described in Chapter 11.
12 Results and discussion current situation

This chapter is completely removed because of confidentiality. The chapter can be requested at Erik van Tol (DHL Express NL)
13 Results and discussion scenarios

This chapter is completely removed because of confidentiality. The chapter can be requested at Erik van Tol (DHL Express NL)
Phase 6 – Evaluation

The final phase is the evaluation phase. In this phase, the main conclusions that could be drawn from the project are described in the first chapter, followed by an enumeration of the main recommendations in the second chapter.
14 Conclusions

The first chapter introduced the problem and the second chapter started with the question as formulated by DHL Express NL at the beginning of the graduation project. This question is showed again below.

How can DHL influence the transported volume, the network capacity and the processes within the DHL Express NL system, on the basis of the system’s capacity utilization, in order to improve the profit margin?

A rough analysis was needed to transform the initial question into two project objectives, which must lead to a satisfied Operations management team of DHL. The main problem was the structural transparency into the resource utilization and flexibility. This lack may influence the profit margin, since a surplus or shortage in the resource availability leads to extra costs per piece. The two objectives that are formulated following the rough problem analysis are:

1. Create transparency about the resource utilization and flexibility at DHL Express NL by means of a dashboard
2. Embed the dashboard into the Operations department to support the managers on medium long term decisions

The achievement of the first goal must lead to structural transparency in the utilization and flexibility of resources. Transparency makes it possible to perform better on resource management. The achievement of the second goal must lead to a desired performance on resource utilization in the future and the resource utilization must lead to a higher profit margin, which will probably improve the market position of DHL Express. A six phase approach is used in order to achieve the project goals. The first section explains the general conclusions that can be drawn from the project; the second section explains the specific conclusions.

14.1 General conclusions

The general conclusion is that both objectives have been achieved. The conclusions that can be drawn with respect to the objectives can be formulated in the following way

1. The dashboard that is created and the key performance indicators that are displayed on the dashboard match with the requirements of the Operations management team

The dashboard is accepted by the Operations management team from a qualitative perspective as well as from a business need perspective. From a qualitative perspective can be concluded that the key performance indicators are carefully defined in partnership with the Operations management team. Furthermore, the conclusion can be drawn that the dashboard functionality and layout are designed and built in accordance with the management team. These activities guaranteed the dashboard approval of the Operations management team.

From a business need perspective can be concluded that there really is business need for a dashboard that displays the resource utilization and flexibility. The curiosity to the results during the feedback sessions indicated the need for transparency in the performance of the resource utilization and flexibility. Furthermore, it is concluded that such a dashboard does not exist within the organisation at the moment. DHL Express NL already uses dashboards and scorecards at a national level to visualise the performance. However, these overviews are all mainly focused on service performance and costs. The main dashboards and scorecards
that are used by the Operations management team to monitor the performance, do not contain key performance indicators reflecting the utilization and flexibility of resources. Some operational reports do contain one or a few indicators on this topic, but there is no overview of all key performance indicators in this field. These findings endorse the added value of an extra dashboard on the resource utilization and flexibility.

2. The dashboard is embraced by the management team and is embedded in the organisation

The first objective already showed that the Operations management team is enthusiastic about the dashboard and that the business need is present. The dashboard itself is embraced by the management team. In order to make the dashboard effective, the management team has taken the responsibility to embed the dashboard into the organisation.

First, the Managing Director has accepted the role of dashboard owner. The Managing Director is the chairman of the management team and a very appropriate person to be the dashboard owner, since this person establishes the agenda for the management team and is responsible for the entire management team. The Managing Director will add the discussion about the dashboard results to the agenda on a monthly basis.

Second, the Operations Programs manager is appointed as the responsible person to assign an administrator of the dashboard. At the moment, the Project Manager Equipment is assigned to execute the updates on a monthly basis and adapt the dashboard to changes. The first meeting to transfer knowledge has already taken place and the necessary information and documents are saved on the Operations directory at the server.

Third, a dashboard owner and dashboard administrator make it possible that the results will be discussed. Additionally, it is necessary to really use these results on a structural basis to improve the performance. The dashboard’s logbook provides the function to register information about the measures that the Ground Operations managers are going to take. It gives an overview of the agreed actions, the current status and due date for the actions, which must lead to the completion of the actions. The logbook forms the final part of the embedding process.

The achievement of the second objective is partly achieved by organisational aspects, like the designation of a dashboard owner and a dashboard administrator, but partly also because of the content of the dashboard: a dashboard that does not meet the requirements would not have been received that well. The opposite is also true: the dashboard is most effective when it is well embedded into the organisation, since it then drives action.

14.2 Specific conclusions

Next to the general conclusions, seven conclusions can be drawn about specific aspects of the project.

3. A dedicated dashboard was necessary to meet the management team’s requirements

Research on performance measurement clarified that the scope and business level of those models does not fit with the scope of the project. Therefore a new dashboard must be constructed. Well-known models in the field of logistics are the Balanced Scorecard, the SCOR model, the INK model and the Activity-Based Costing model. Those models appeared to have a different scope. Mostly because they focus on a strategic business level and on the quality and cost perspective of the performance. Therefore it is decided to construct a dashboard based on key performance indicators customised to the preferences of the DHL Operations management team.

Furthermore, the requirement to display the future performance necessitated a second version of the dashboard. In fact, the same dashboard is used to display the performance, but stochastic parameters are added to the raw data to simulate the possible future situations.
4. Unambiguous definitions of utilization and flexibility and of the key performance indicators’ names are of great importance for the value of the dashboard.

Utilization is defined as the actual usage of the (available) resources over the maximum sustained production possible over some interval. The flexibility is defined as the variability in the deployment of the amount of resources that do not have financial consequences if they are not deployed.

The definitions are very important for the understanding of the KPIs and the usage of the KPIs in the future. Different interpretations of the words utilization and flexibility by the management team can easily lead to miscommunication.

The feedback sessions confirmed that too many and too similar KPIs cause confusion. The names of the KPIs were very generic in the first version. The KPI names all started with ‘utilization of’ and ‘flexibility of’ and the part after these phrases were generic as well. This caused confusion. The KPIs are therefore renamed: the terms utilization and flexibility are removed and the rest of the name was made more concrete. The terms utilization and flexibility are used on the dashboard as subgroups to indicate to which category a KPI belongs.

Furthermore, the amount of personnel KPIs appeared to be too large in the first version of the dashboard KPIs. Especially the category personnel contained too many KPIs and the KPIs were often mixed up. Therefore, the amount of personnel KPIs was reduced.

5. The results of the dashboard endorse the feelings of the management team about resource utilization

At the beginning of the report it is stated that the Operations management team has the presumption that the utilization of the resource is not at a desired level and that the flexibility of personnel and vehicles is too low to react on the changing volumes.

The results showed that the performance of the resources were not all within the desired range. Mainly the amount of drivers with a C driving license in comparison to the amount of vehicles that require a C driving license and the utilization of small and large vehicles are alarming. The findings endorse that the presumptions of the Operations management team are founded.

It must be kept in mind that some of the data is spoiled by wrong license plate registration and a too high amount of parcels registration. This mainly influences the vehicle utilization. However, the vehicle utilization is very low, probably also without a registration error.

6. The scenario dashboard showed the importance of volume size for the resource utilization

The results of the 20% volume growth scenarios show that the utilization of resources will increase significantly, without changing the composition and the amount of resources. Reducing the network is not necessary then. However, the results are moderately positive if the extra volume must be delivered at existing receivers, since this leads to an increasing efficiency. The situation is very positive from a productivity point of view of course, but in that case, the network may still be reduced. This situation illustrates the tension between the utilization on the one hand and the productivity on the other hand.

Nevertheless, the terminal related resources are well utilized in all growth scenarios. This is important, since it is the least flexible resource type. The results on the contraction scenario show a disaster when this becomes the actual situation. Reducing the amount of resources is inevitable in that case. It is thus necessary to focus on the acquisition of extra volume.
7. **Familiarity, support and commitment have led to the embedding of the dashboard into the organisation**

   Familiarity is created by the management conference and conversations with staff Operations managers. Support is created by conducting small surveys about performance measurement at DHL Express NL and by discussing the added value of the dashboard. The construction of a dashboard with preferred and desired key performance indicators is a good first start. However, the dashboard must be embedded into the organisation to make the dashboard really useful. Familiarity, support and finally commitment have been necessary to achieve the second goal. Familiarity and support thus contribute to the achievement of the second goal.

   Commitment is mobilised by organising feedback sessions with the Operations management team. A system analysis, process analysis and selection of performance indicators by DHL experts have led to a selection of key performance indicators. This list is discussed with and adapted to the preferences of the Operations management team during the feedback sessions. Those sessions led to a dashboard (for the current situation and for the future situation) that is corresponding with the expectations of the team. This approval is the second step towards the achievement of the second project goal.

8. **The dashboard does fit into the organisational structure**

   The dashboard fits into the organisational structure. First, the employees of DHL Express NL Operations, especially the managers, are used to work with dashboards and scorecards already. A lot of operational data is saved at servers and analysed by means of reports, dashboards and scorecards.

   Furthermore, the dashboard uses green, orange and red boxes and smileys to indicate whether the performance is sufficient or not. This way of displaying performance is often used at the Operations department. Therefore, the dashboard is recognizable and probably easier to understand and interpret at first side.
15 Recommendations

As Chapter 14 described, the two project objectives are achieved. However, there are some points of attention. These are formulated as recommendations in this chapter. The section is divided into recommendations on the KPIs and the dashboards and recommendations for DHL Express NL.

15.1 Recommendations on the key performance indicators and the dashboard

Three recommendations are formulated for the key performance indicators and the dashboard.

1. **Keep the assumptions of the dashboard up to date**
   The dashboard uses data from other models and tacit knowledge from DHL employees. This data is probably accurate and up to date now, but it is important that this information remains up to date in the future. Therefore, it is recommended to check the values of the assumptions and improve the values when necessary.

2. **The accuracy of the scenario dashboard’s coefficients may be further improved.**
   The set up of the scenario dashboard is simple. Nevertheless, the dashboard functions well and meets the nice-to-have requirements. It is recommended to refine the mechanism of the dashboard and to calculate the coefficients more accurately in order to make the predictions about the performance more accurate.
   An example of an improvement for the mechanism would be to convert the calculations in a way that the volume will not equally be spread over the Netherlands, but that some regions have a higher volume growth or decrease than others.
   Another idea is to fulfil the nice-to-have requirement and build the scenario data set that the composition and amount of resources of the terminals can be varied as well.

3. **The financial consequences of the dashboard results could be further refined**
   The financial analysis is briefly conducted. This means that the financial consequences are just a rough estimation and calculated at a system level. For the goal of this project, it is sufficient. However, it would be optional more insight in the financial consequences of the idle resources, for example at a terminal level, since maximising the profit margin is the final goal of the company. Maybe the cost-based analysis that is performed two years ago can be used to refine the financial consequences.

15.2 Recommendations for DHL Express NL

Recommendations for DHL Express NL concern raw data, the usage of the key performance indicators, the dashboard and some general recommendations.

4. **Remain aware of the relation between the utilization of resources on the one hand and the productivity and service performance on the other hand**
   The Operations management team of DHL Express is aware of the function of the dashboard, since they were involved in the creation of the dashboard. However, it is important that the managers remain aware of the fact that this dashboard is only a dashboard to raise the right questions and not to give the answers.
   This resource utilization and flexibility dashboard must not be optimised, since optimising this dashboard would probably lead to a sub optimisation of the whole system from a cost perspective.
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and quality point of view. The position of resource utilization must be clear to use the dashboard properly.

5. **Improve the accuracy of the registration of the license plates and the unique amount of parcels.**

The license plate registration problem causes a lower accuracy of the input data and therefore also of the results. A focus on the registration of these license plates would already increase the accuracy of the raw data significantly.

The central storage of information about the unique amount of parcels is a problem that is less simple to improve. The data is available at a terminal level and it is available at a nationwide level, although it is very time consuming. That is the reason why the data cannot be used at a central level at the moment. Cooperation between the departments IT and Operations would be necessary to achieve central data storage of unique parcels, but it will result in valuable information, since this dashboard is not the only tool that requires the unique registered amount of parcels at a nationwide level.

6. **Remain critical on the key performance indicators' composition, definitions and norm values**

The key performance indicators are now defined in cooperation with the Operations management team, but the preferences or requirements can change. For example by a different strategy, which implies a change of the points of attention. The previous management conference was about transparency and growth, in which the project perfectly fits. The next one can focus on something totally different. It is recommended to critically evaluate the key performance indicators' composition, definitions and norm values frequently in order to determine whether they are still relevant to measure, monitor and manage.

In order to remain critical, it is very important that the future users know the dashboard and the function of the dashboard. The Operations management team has been involved in the construction of the dashboard. However, other (staff) managers will come in contract with it as well. For example, the terminal managers of the fourteen terminals of the staff managers of the Operations department.

It is recommended to organise a short workshop about the idea behind the dashboard and the usage of the dashboard. It must be clear that these key performance indicators are not like the others, since nobody will directly be accountable for insufficient results. The dashboard is used as a health check and not as a tool to judge one another's performance.

7. **Monitor the key performance indicators 'C-license drivers vs. C-license vehicles' and 'Utilization # DHL vehicles'**

The results of the dashboard were moderately positive. Some key performance indicators already have a desired value, others do not. The values of the key performance indicators 'C-license drivers vs. C-license vehicles' and 'Utilization # DHL vehicles' are the most alarming ones at the moment.

The utilization of large vehicles is very low at the moment. The causes of this insufficient performance are not clear. Possible causes are a very low utilization of tractors during the night, a shortage of drivers with a C driving license or an extremely low amount of volume. The dashboard does not give the answer, but it is interesting to find out, since every cause requires other measures on the medium long term.

It is recommended to find out the causes of these low utilization and flexibility when the key performance indicators' values remain low. It probably is caused by a low fleet utilization during the line haul process at night. When this is the case, and only then, it is recommended to reconsider the composition of the fleet.

8. **Keep the logbook up to date**

The logbook can be very valuable for the dashboard, since it may functions as a memory. The logbook presents points of attention, the corresponding measures and the due date. This
probably leads to a more structured way of dealing with the problems. Furthermore, the managers are forced to face the facts as well.

9. Mobilise commitment of the Sales department to the dashboard results

At the moment, the cooperation between Sales and Operations occurs on an ad hoc basis. The conclusions of the previous chapter made it clear that the volume size needs to increase in order to remain the current extensive network.

At the moment, all terminals have overcapacity and can handle extra volume. However, capacity problems may exist if the volume is increasing. It is important that the cooperation between Sales and Operations becomes more tight, since the volume acquisition and the operational capacity can be better aligned then. It is therefore recommended to get the Sales department involved in discussing the dashboard results.
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A. OSI model and applied OSI model

OSI is the abbreviation of ISO Reference Model for Open Systems Interconnection. The OSI reference model of the International Organisation for Standardization (ISO) includes the similarities of structures between different networks that were designed previously. The model consists of 7 layers. The three layers at the bottom deal with transmission, while the upper four layers deal with communication services for the users. (Walrand, 1991) Figure A-1 show the OSI model of the ISO.

This model is used as an inspiration to structure the information about the company DHL Express, since the company can also be divided into several layers. However, the model is not directly applied to DHL, since the company is not a communication network. The layer model gives a structure to fathom the organisation: from the service that is offered to the customers to the infrastructure that is needed to offer the service.
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Figure A-2 Applied OSI model of DHL Express

The upper layer is about the service that is provided by DHL. This service focused on in this project is the Day Definite service, which consists of a domestic and an international service. The service is provided from sender to receiver.

The service that is offered transports shipments. The shipment is the largest unit that is handled by DHL Express. A shipment consists of one or several pieces. The pieces are transported from sender to receiver. Different types of transport takes place. These transportations occur during processes:

- The pickup and delivery process, which picks up the shipment at the customer and delivers the shipment at the receiver.
- The line haul process, which takes care of the transportation between terminals
- The terminal handling process, which takes place at the terminal. This process mainly consists of sorting the pieces for the right destination.

Transportation takes place in a network. The network consists of terminals (buildings where the pieces are sorted) and linehauls between those terminals. The resources of the network form the lower layer of the network. The resources are the buildings, the vehicles and the employees.
B. Day Definite products and goods specifications

This Appendix show the specifications of the different products and goods. The Day Definite service consists of several products. The products determine the conditions and the delivery time for example. The transported goods are divided into several categories. Those types of goods are explained in this Appendix as well. The information is derived from the productbook site of the intranet. This page contains all information about the services and products that are offered by DHL Express NL. (DHL Express NL, 2010m)

**Europlus product specifications**

There are some restrictions for shipping goods by the Europlus product. These are summed up below.

**Size:**
- Minimum size (cm): 15 x 11 x 3,5
- Maximum size (cm-parcel): 120 x 60 x 50 (l x w x h)
- Maximum size (cm-pallet): 120 x 100 x 200 (l x w x h)

**Weight:**
- Maximum weight (kg - parcel): 31,5 kg
- Maximum weight (kg - pallet): 1.000 kg
- Maximum weight per shipment: No Limit
- Parcels weighting over 50 kilo, will be invoiced as a pallet
- For pallet shipments a minimum weight of 175 kg per pallet applies
- A surcharge applies for parcels between 31,5 kg and 50 kg (Extra Heavy)
- Maximum volume per shipment: 12 m³

**General:**
- Maximum items per shipment: 5 pallets
- Volume weight conversion: 250 kg/m³

**Expresser product specifications**

There are some restrictions for shipping goods by the Expresser product. These are summed up below.

**Size:**
- Min. size (cm): 15 x 11 x 3,5 (l x w x h)
- Max. size (cm-parcel): 120 x 60 x 50 (l x w x h)
- Max. size (cm-pallet): 120 x 100 x 200 (l x w x h)

**Weight:**
- Min. weight: no limit (according to local law)
- Max. weight per item (kg-parcel): 31,5 kg
- Max. weight per item (kg-pallet): 1.000 kg
- Max. weight per shipment (kg): No Limit
- Volume weight conversion: 250 kg/m³

**Depot Restante:**
- This only applies for destinations in The Netherlands. Depot restante shipments for service points and for Saturday morning must be sent as Expresser. Your depot restante Expresser shipment can be collected from the service points from 8.00 hrs to 19.00 hrs. For a list of our service points, please contact Customer Service at 0800-0552. A depot
restante Expresser shipment for Saturday can be collected in The Netherlands from the branch between 8.00 hrs and 10.00 hrs.

**General**
- Max. items per shipment: 5 pallets.
- Expresser is not possible in combination with Saturday Delivery
- Suitable packaging required for transport; Parcels must be suitable for mechanical sorting.

**Economy select product specifications**
There are some restrictions for shipping goods by the Economy select product. These are summed up below.

**Size:**
- Minimum size (cm): 15 x 11 x 3,5
- Maximum size (cm-parcel): 120 x 60 x 50 (l x w x h)
- Maximum size (cm-pallet): 120 x 100 x 200 (l x w x h)

**Weight:**
- Maximum weight (kg - parcel): 31,5 kg
- Maximum weight (kg - pallet): 1.000 kg
- Maximum weight per shipment: 2.500 kg
- Parcels weighting over 50 kilo, will be invoiced as a pallet
- For pallet shipments a minimum weight of 175 kg per pallet applies
- A surcharge applies for parcels between 31,5 kg and 50 kg (Extra Heavy)
- Maximum volume per shipment: 12 m³

**General:**
- Volume weight conversion: 250 kg/m³

**Descriptions types of goods**
The different appearance types of the goods are explained and illustrated with a figure.

**Parcels**
The parcels (also: conveyables) are sorted by the sorting equipment (sorter). This sorter consists of a main conveyor (hence the name conveyable) and many chutes. The amount of chutes varies per terminal. The shipments end up at the right chute so that all shipments for the same vehicle are at the same location in the terminal. The sorting process makes dimension and weight restrictions inevitable. However, the maximum allowed dimensions for parcels differ from the Day Definite products.

![Figure B-1 Parcel](image-url)
Non-conveyables
Non-conveyables (NCYs) are pieces that cannot be sorted by the sorting equipment for a variety of reasons. For example: the package in question cannot be sorted by the sorter because it is heavier than the maximum weight, because one dimension is bigger than 70 cm or because of its deviant shape. Other packages that belong in this category are objects with wheels, unstable objects and cylinder-shaped items. Figure B-2 show cylinder shaped items that belong to the category non-conveyable.

![Figure B-2 Non-conveyables](image)

Pallets
A special appearance type of a NCY is the pallet. Pallets used by DHL are mostly Euro pallets nowadays (with dimensions of 1.20x0.80 m) However, pallets with other dimensions are used as well, like the industrial pallets (1.20x1.00 m), which used to be the main pallet type and like pallets with half the size of a euro pallet (0.6x0.8 m).
Pallets are used to carry heavy pieces or several pieces at once. It is obligatory to put pieces on a pallet if the piece is heavier than 50 kg. The maximum dimensions for pallets are 120x100x200cm. (The width and length are equal to an industrial pallet) The maximum weight per pallet is 1000kg.

![Figure B-3 Pallets](image)
C. Day Definite International Service

The Day Definite International (DDI) process is more complex than the Day Definite Domestic (DDD) service, since this process contains extra activities. Figure C-1 shows the DDI process. It must be kept in mind that the pickup terminal and delivery terminal are not located in the same country, since it concerns an international shipment.

The process is equal from the sender to the pickup terminal. The DDD shipments are also transported by a domestic linehaul, but all the international shipments go to the gateway instead of a terminal. The gateway is a specialized terminal and forms the connection with the foreign countries. For the Day Definite service, the gateway is located in Eindhoven in the same building as the DD terminal in Eindhoven.

From the outbound gateway, the shipment go with an international line haul to the right country. The shipment arrive at a inbound gateway, which means that the gateway functions as an arrival building. From there, the shipment is going to the delivery terminal by truck and the rest of the process is equal to the DD process again. Local delivery provide the delivery at the customer.

![Diagram of Day Definite International process and sub processes](image)

Figure C-1 Day Definite International process and sub processes
D. Underlying factors of the system analysis

In Chapter 5 the system analysis is explained. This analysis showed the main factors that determine the performance on resources. The three performance aspects are efficiency, productivity and flexibility. This appendix shows the most important underlying factors that determine the performance on resource utilization, resource productivity and resource flexibility.

Underlying factors of the resource utilization

The resource utilization is calculated by the used production means divided by the capacity. Those two aspects are explained below and the graphical overview is showed in Figure D-1.

Capacity

The capacity of DHL personnel can be calculated in hours or employees. The capacity in hours can be calculated by the sum of the employees with a contract with a fixed amount of hours. (For min/max contracts this means the minimal amount of hours.) This is the minimal capacity. The maximum capacity is very difficult to calculate, since the employees with a 0-hour contract does not have a capacity and the maximum amount of hours and employees with a min/max contract is not captured as well. The personnel capacity in employees can be calculated to count the amount of employees with a DHL contract.

The capacity of vehicles can be calculated in vehicles or in loading capacity. The capacity in vehicles is the total amount of vehicles owned by DHL Express. The capacity in loading capacity can be calculated by the sum of all vehicle surfaces (2-dimensional) or by the sum of all vehicle contents (3-dimensional).

The capacity of the terminal is difficult to determine in one number. There are different types of resources within the terminal that have a capacity: terminal door capacity, terminal floor capacity, sorter capacity and equipment capacity. The equipment consists of forklifts and EPTs. The sorter capacity depends on the operational capacity of the sorter and the sort window (time duration). The terminal floor capacity is determined by the size of the terminal. However, the useful terminal floor is determined by several other factors as well, like the amount of doors, the size of a staging area and the terminal layout.

Usage production means

The DHL personnel consist of employees with a contract with a fixed amount of hours and with a flexible amount of hours. The deployment of those two groups of employees forms the usage of DHL personnel. The usage of vehicles and building related resources is obvious. The usage of non-DHL personnel can be defined as the total working hours of the non-DHL personnel or the amount of non-DHL personnel that has worked for DHL. The usage of non-DHL vehicles is obvious as well.
Figure D-1 Underlying factors of the resource utilization
Underlying factors of the resource flexibility

The working hours are built up of overtime hours of employees with a fixed contract, working hours of non-DHL employees and working hours of DHL employees with a flexible amount of hours. As explained earlier, the non-DHL personnel consist of temps and subcontractors (subco). The non-DHL vehicles consist of rental vehicles and subcontractors. The graphical overview of the resource flexibility is presented in Figure D-2.

Figure D-2 Underlying factors of the resource flexibility
Underlying factors of the resource productivity

The productivity is calculated by dividing the actual result by the actual offers. The actual resource is expressed in the amount of volume and the actual offers are expressed by the used resources. Figure D-3 shows the factors that define the resource productivity.

Figure D-3 Underlying factors of the resource productivity
E. Process analysis – Steady state model and PROPER model

Het Steady State Model is the basic model of the Delft Systems Approach. This method can be used to model systems. The Steady State Model only concerns one aspect. In fact, there are three aspects: the material flow, the order flow and the resource flow. The Steady State Model that is applied below is based on the material flow. The three aspects together can be visualised in the PROcess PERformance (PROPER) model. (Veeke, Ottjes, & Lodewijks, 2008) The PROPER model is only used at the highest level of aggregation.

The different aspects of the Steady State Model are explained. Thereafter the applied version of the Steady-state Model is presented and discussed. The definitions of the Steady State Model's aspects are directly copied from the book. (Veeke, Ottjes, & Lodewijks, 2008)

Next to the Steady-state model the SADT method is used to model the processes and required resources. The final part of this appendix show the combination of the detailed Steady-state model and the SADT model.

Steady State Model aspects

Execution process
- **Encoding**: to ensure that the input is suitable for handling by the transformation function.
- **First filter**: To ensure that the input has the required quality. For that purpose this function controls the input for quality. It can only accept or reject.
- **First buffer**: To absorb the fluctuations in the input flow.
- **First safety function**: To ensure that the buffer is not over-supplied. For this purpose it ensures that the excess from a full buffer is discharged into the environment.
- **Transformation**: To actually convert the input to the desired process output.
- **Second filter**: To ensure that no imperfect products or services are delivered to the environment. For this purpose the quality of the output is inspected (and eventual deviations are passed on to the comparing function in the feedback loop.)
- **Second buffer**: To absorb fluctuations in the output when the output cannot be delivered to the environment due to circumstances.
- **Second safety function**: To ensure that the environment can take up the output. For this purpose it ensures that the excess in a buffer is discharged into the environment.
- **Decoding**: To ensure that the environment can take up the output. For this purpose it brings the output into the required state.

Process control loops
- **Measurement of the feed forward**: The measurement of disturbances in the process within the system's boundaries.
- **Comparing function for the feed forward loop**: Comparing the values of disturbances with the given tolerance margin and reporting the excesses of the control function.
- **Measurement for the feedback**: Post-transformation measurement of deviations as opposed to the given standards for all desired facets.
- **Comparing function for the feedback loop**: Comparing the to be controlled facets of the transformed with the standards and deviations passed into the control function.
- **Control function for the feed forward and feedback**: To enable the process to take place within the given standards. For this, it determines the necessary interventions to bring this and that back again with standards.
- **Intervention function**: To carry out the interventions as chosen by the control function.

**Function control loop**

- **Measurements for the purpose of setting standards**: The measurement of all sorts of facets of the output and the state of the system over a longer period of time.
- **Evaluating function**: Comparing these measurements with the standards and passing on consistent deviations to the initiating function. It must also signal changes in the system's environment that enforces a change in the standards.
- **Initiating function**: Setting standards on the grounds of data from a control loop from a next higher echelon or from the level of development. Or changing standards based on the data from the evaluating function.
Applied Steady State Model
The language of this section is fully in Dutch, since it is used as feedback document for DHL employees and the main language of communication is Dutch on the Operations Department of DHL Express NL.

Opmerking vooraf: Een 'pakje' = alle vormen van goederen die door DHL vervoerd worden, zoals documenten, pakketten, pallets en non-conveyables (goederen die niet via de sorteermachine gesorteerd kunnen worden, maar met de hand of met behulp van een heftruck.

Execution process: Pakjes brengen van A naar B

- **Receive and assign the booking**: Dit blokje is bewust buiten de systeemgrenzen gehouden. Het representeert het boekingsproces. Wanneer er een boeking binnenkomt, wordt er gekeken door welke terminal dit pakje moet worden verwerkt. Daarna gaat de order verder het systeem in.

- **Provide barcode to piece(s) of the shipment**: Het pakje wordt voorzien van een barcode, zodat dit pakje verwerkt kan worden in het gehele proces.

- **Are the requirements met?**: Voordat het pakje bij de klant wordt opgehaald, bekijkt de chauffeur of het pakje wel voldoet aan alle eisen, zoals afmeting-, gewicht- en vormeisen. Dit gebeurt deels ook op het moment wanneer de boeking plaatsvindt, maar het pakje kan pas in het echt bekeken worden wanneer de chauffeur op de stoep staat. Het boekingsproces is niet meegenomen, dus deze filter is dan ook buiten beschouwing gelaten.

- **First buffer**: is er niet. Bufferen voordat een pakje het proces in gaat is niet aan de orde. Op dit moment bevindt het pakje zich nog bij de klant. Wanneer het pakje is opgehaald, gaat het meteen het proces in.

- **First safety function**: is er niet. Er is geen buffer, dus er is ook geen safety function nodig.

- **Shipping shipments from sender to receiver**: pakjes brengen van locatie A naar locatie B. Dit proces zal later in meer detail worden uitgelegd.

- **Is the receiver the right receiver**: Het controleren of het juiste pakje bij het juiste adres en bij de juiste persoon wordt afgeleverd. Wanneer het niet klopt, kan het pakje mee terug worden genomen door de chauffeur.

- **Non-delivered shipments**: het mee terugnemen van pakjes in het voertuig (bestelbus of vrachtauto) en het neerzetten op de terminal wanneer de pakjes niet afgeleverd kunnen worden. Dit kan zijn wanneer de ontvanger niet thuis is of als er een pakje mee is gegaan met het verkeerde voertuig.

- **Second safety function**: is er niet. Pakjes die niet afgeleverd kunnen worden, zullen nooit weggegooid worden en zullen altijd mee terug gaan naar de terminal. De buffer kan volraken, maar deze kans is klein. Dit gebeurt alleen al ser heel veel pakjes mee terug moeten en als er heel veel pakjes moeten worden opgehaald aan het einde van de dag.

- **Decode**: is er niet. Het pakje wordt direct aan de klant geleverd en de klant moet de verpakking er zelf afhalen. Bovendien kan het pakje zo het systeem uit, zonder aanpassingen te doen. Het krijgt wel een code, zodat het systeem weet dat het pakje is afgeleverd, maar het ondergaat geen veranderingen.

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Are the requirements met?

Is receiver the right receiver?

Figure E-1 Execution process DHL Express NL

Process control loops

- **Measurement of the feed forward**: er is geen feed forward voor dit proces

- **Comparing function for the feed forward loop**: er is geen feed forward voor dit proces

- **Measurement process performance**: Door scans op allerlei momenten in het proces kan gemeten worden wanneer het pakje het proces in is gegaan en het pakje is afgeleverd. Hiermee kan berekend worden of het pakje op tijd afgeleverd is. Verder kunnen er met deze gegevens nog veel meer dingen gemeten worden, waaronder alle KPI's die op dit moment al gemeten worden, plus de nieuwe KPI's die zijn bedacht voor dit onderzoek en later aan bod zullen komen. Wat betreft productiemiddelen kan er berekend worden hoeveel productiemiddelen er gebruikt worden, welke er gebruikt worden en hoe lang ze gebruikt worden.

- **Comparing process performance**: Hier wordt de doorlooptijd vergeleken met de voorgeschreven doorlooptijd op basis van de gekozen service (voor 11.00/einde van de werkdag) Maar ook de andere KPIs kunnen op basis van deze comparison functie vergeleken worden met de targets.

- **Initiating process performance**: targets for the KPIs. Deze KPI's worden soms al op wereldwijd of europees niveau bepaald, maar het kan ook gewoon door werknemers in Nederland bepaald worden, zoals voor het dashboard in dit project.

- **Control**: Deze functie maakt het mogelijk om de pakjes op tijd te bezorgen, bijvoorbeeld door genoeg mensen en auto's beschikbaar te stellen en voldoende ruimte te bieden in de terminal. De eindverantwoordelijkheid van deze taak ligt bij de Managing Director Operations DD.

- **Intervene**: Deze functie maakt het mogelijk om acties uit te voeren wanneer het proces niet onder controle is. Bijvoorbeeld door extra mensen in te zetten op drukke tijden, of de pakjes op een andere manier over de auto's te verdelen zodat ze wel allemaal op tijd bezorgd kunnen worden.
**Function control loop**

- **Measurements for the purpose of setting standards**: Hier worden niet alleen alle operationele zaken gemeten, maar worden ook de rest van de organisatie meegenomen. KPIs die hier gebruikt worden zijn o.a. de EBIT en andere financiële KPIs, maar er kan ook gedacht worden aan een tevredenheidsonderzoek onder de klanten of medewerkers.


- **Initiating function**: Deze functie vertaalt de doelen die vanaf het internationale hoofdkantoor komen (requirements) in doelen die afgestemd zijn op DHL Express NL. Deze doelen worden weer vertaald naar standaarden die gebruikt worden bij de operatie. Daarnaast hebben een deel van de eisen van de klanten invloed op de initiating function. Ook deze worden meegenomen om in de standaarden te kunnen verwerken. Deze stappen zullen hier niet in verder detail worden doorgesproken. Een methode om dit gestructureerd te kunnen doen is door gebruik te maken van een strategy map, ontwikkeld door Kaplan en Norton. (Kaplan & Norton, 2000)

---

**Figure E-2 Executing process and process control**

1. **Receive and assign booking**
2. **Provide barcode to piece(s) of shipment**
3. **Shipping shipments from sender to receiver**
4. **Delivered shipment**

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Figure E-3 First steady state model DHL Express NL
Steady state model DHL Express NL with a more detailed transformation function

Vanaf hier zijn de toegepaste termen niet meer in het model weergegeven, maar is de functie zoals deze in het Steady-state model heet, weergegeven. Dit is gedaan omdat er anders niet genoeg ruimte is om alle tekst kwijt te kunnen in de figuren, omdat er steeds meer bouwblokjes bijkomen. De functies staan wel nog steeds gewoon bij de figuur beschreven.

Executing process

- **Transformation 1**: Het pick-up proces. Het pakje wordt opgehaald bij de verzender.
  - **Buffer a**: Nadat het pakje is opgehaald, wordt het niet meteen verwerkt, maar eerst meegenomen in de vrachtwagen/bestelbus. Dit geldt als buffer na het proces.
  - **Filter a**: Wanneer de pakjes verwerkt worden, worden ze eerst gescand, zodat de bestemming duidelijk is en het pakje gesorteerd kan worden. Dit gebeurt handmatig voor documenten, pallets en non-conveyables en automatisch voor pakketten die met de sorteermachine gesorteerd worden. Wanneer de bestemming niet duidelijk is of er iets mis is, wordt het pakje eruit gehaald en moet er nog eens naar gekeken worden.
  - **Transformation a**: In dit proces worden de fouten van de pakjes die niet het sorteerproces in konden eruit gehaald. Wanneer het pakje is hersteld, kan het verder het proces in
  - **Transformation 2**: Dit is het transit proces en behelst het verplaatsen van de outbound terminal naar de Inbound terminal, al dan niet via de gateway. Dit gebeurt op basis van de bestemming van het pakje die is ingelezen via de barcode op het pakje. Dit proces is hier nog niet verder gespecificeerd.
  - **Buffer c**: Wanneer de pakjes in de juiste terminal zijn gebracht en gesorteerd zijn op eindbestemming (op routeniveau), moeten de pakjes wachten tot de chauffeur ze gaat afleveren.
  - **Filter b**: Wanneer de pakjes klaar zijn voor vertrek, controleert de chauffeur of alle pakjes die klaarliggen voor zijn/haar voertuig goed gesorteerd zijn en of de pakjes allemaal afgeleverd kunnen worden (dit kan niet wanneer een deel van de bestelling ontbreekt of wanneer een pakje gevaar kan opleveren, zoals door los glas). Wanneer dit niet het geval is, kan het pakje mee met de chauffeur.
  - **Transformation b**: Bij dit proces komen alle pakjes terecht die verkeerd gesorteerd zijn. Dit proces zorgt ervoor dat de fout hersteld wordt en het pakje alsnog het bestelproces in kan gaan.
  - **Transformation 3**: Dit proces is het afleverproces, ook wel delivery genoemd. De chauffeurs rijden met hun voertuig langs alle adressen waar ze een bestelling voor hebben.
Executing process and process control loops

In deze tekening staan geen nieuwe symbolen. In het transformatieproces wordt veel gemeten, maar het vergelijken met de standaarden gebeurt pas als het pakje de hele transformatie heeft doorlopen en is afgeleverd bij de klant. Vandaar dat er geen gedetailleerdere process control loops zijn opgenomen. Natuurlijk vinden er wel process control loops plaats binnen de verschillende transformaties, maar deze zijn niet meegenomen op dit detailniveau en zullen alleen van belang zijn op een hoger detailniveau.
Figure E-5 Transformation 2 – executing process and process control loop
Steady state model
Ook in deze tekening zijn geen nieuwe symbolen opgenomen. Ten opzichte van de vorige tekening is alleen de function control loop toegevoegd aan deze tekening. Deze is al eerder besproken en zal hier niet opnieuw worden uitgelegd.

Figure E-6 Steady state model
Steady state model DHL Express NL with a more detailed transformation 2 function

Voor dit model is alleen het executing process weergegeven, omdat de control loops het alleen maar onduidelijker maken en weinig toevoegen ten opzichte van de figuren die er al zijn.

De symbolen die in de grijze rechthoek staan weergegeven, vallen bij dit onderzoek buiten de afbakening. Deze processen zijn namelijk onderdeel van het proces op de gateway en dit valt onder de verantwoordelijkheid van DHL Hubs & Gateways en niet van DHL Express. Voor de volledigheid is hier wel de gehele keten getekend en uitgelegd.

Onder de figuur staan alle functies binnen transformation 2 uitgelegd.
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Figure E-7 Transformation function 2 – executing process
• **Transformation 2a:** Dit is het sorteren van de pakjes. Voor pallets gebeurt dit door te scannen en met een heftruck of EPT een pallet naar de juiste locatie binnen de loods te verplaatsen. Pakketjes worden via de sorteermachine gesorteerd. Dit gaat dus automatisch. Aan de "voorkant" zetten mensen de pakketjes op de band en aan de "achterkant" halen mensen de pakketjes er weer vanaf, zodat de goten niet vol lopen. De documenten worden handmatig gesorteerd en voor de douane plichtige zendingen moeten er gegevens in het systeem gezet worden, zodat deze gecontroleerd kunnen worden door de douane.

• **Encode a:** Wanneer de pakketjes gesorteerd zijn, kunnen ze in kooien gestopt worden, zodat ze makkelijker te verplaatsen zijn. De documenten worden in zakken gestopt, zodat ze makkelijker vervoerd kunnen worden.

• **Buffer I:** Nadat de pakjes gesorteerd zijn, liggen deze te wachten totdat de in een vrachtwagen geladen kunnen worden en met een binnenlandse line haul naar een andere terminal of naar een gateway gebracht kunnen worden.

• **Transformation 2b:** Deze transformation representeert de line haul van de vertrekterminal naar een gateway of direct naar een aankomstterminal. Dit is het (begin van het) transit proces.

• **Buffer II:** Deze buffer representeert het wachten na aankomst op de gateway.

• **Decode a:** Dit is het uitpakken van de kooien en zakken op de gateway.

• **Filter I:** Op de gateway vindt ook een sorteerproces plaats voor de juiste bestemming. Wanneer een pakje niet gesorteerd kan worden, wordt deze eruit gehaald. Dat wordt weergegeven met dit filter.

• **Transformation I:** Deze transformation stelt het proces voor waarbij de pakjes die niet gesorteerd konden worden, hersteld worden. Daarna kunnen de pakjes dan alsnog gesorteerd worden.

• **Transformation 2c:** Het sorteren van de pakjes op de gateway. Voor pallets en documenten gebeurt dit handmatig, voor pakketten gebeurt dit automatisch.

• **Encode b:** Wanneer de pakjes zijn gesorteerd, worden ze weer ingepakt voor vervoer: documenten in zakken en pakketten in ULD's, zodat ze in het vliegtuig kunnen.

• **Buffer III:** Na het sorteren moeten de documenten, pakketten en pallets wachten tot ze geladen kunnen worden. Meestal voor het laden in een vliegtuig, maar in een klein deel van de gevallen voor het laden in een vrachtwagen.

• **Transformation 2d:** Dit is de internationale line haul die de pallets, documenten en pakketten naar de juiste aankomst gateway transporteert.

De blokjes in de grijze rechthoek van het Inbound proces geven precies dezelfde processen weer als hierboven beschreven, alleen dan voor de aankomst gateway in plaats van de vertrek gateway. Omdat dit gateway Inbound proces toch niet wordt meegenomen, wordt dit niet in meer detail uitgelegd.

• **Decoding c:** Het uitpakken van de kooien en zakken die met de binnenlandse line haul zijn aangekomen.

• **Buffer VII:** Het wachtproces voordat de pakjes gesorteerd worden. Meestal wordt er gewacht totdat er genoeg volume is, zodat dit proces achter elkaar kan doorgaan en er niet steeds gewacht hoeft te worden op nieuw volume.

• **Filter IV:** Dit filter haalt de pakjes eruit die niet gesorteerd kunnen worden.

• **Transformation III:** Dit transformatieproces voert herstelactiviteiten uit voor de pakjes die niet gesorteerd kunnen worden, zodat ze alsnog het sorteerproces in kunnen.

• **Transformation 2g:** Dit is het sorteerproces op de Inbound terminal. De pakjes worden hier op routeniveau gesorteerd, zodat alle pakjes uit hetzelfde gebied bij elkaar in 1 voertuig zitten.

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Connection of processes and Key performance indicators
This part of the appendix shows the connection between the processes as defined in the previous part and the possible key performance indicators per subprocess. Furthermore, the detailed process analysis is linked to a more detailed process description that is made by using the SADT (structural analysis and design technique) method. This method describes the relation between processes, and show the input, output, control and mechanisms of the process. Figure E-8 show the building blocks of the SADT structure.

![Figure E-8 SADT structure](image-url)
Transformation 1 - Pickup process

![Diagram of the pickup process]

**Figure E-9** Pick up process with control loop

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• **Measures:**
  - Aantal chauffeurs ingezet voor het pick-up proces (per type contract)
  - Tijdsduur route preparation
  - Tijdsduur on route
  - Tijdsduur on tour
  - Tijdsduur debrief
  - Tijdsduur totale werkdag
  - Aantal voertuigen ingezet voor pick-up proces (hetzelfde aantal als het aantal chauffeurs als het goed is)
  - Aantal deuren ingezet voor het pick-up proces
  - Aantal kilometers gereden per route
  - Lengte per route
  - Aantal pakjes (per type en service)
  - Tijdstip waarop het pakje is opgehaald
  - Hoeveelheid pakjes die niet met de chauffeur meegaan wegens verschillende oorzaken
  - Verschil in opgegeven aantal pakjes en werkelijk aantal meegegeven pakjes
  - Aantal ziekte/niet-beschikbare uren

• **Standards:**
  - Pick-up procedures
  - Unload instructions
  - Pickup targets

• **Compare:**

• **Capacity:**
  - Totaal aantal voertuigen (= vloot, uitsplitsing maken naar typen)
  - Totaal aantal chauffeurs voor pick-up (uitsplitsing maken naar type contract)
  - Totaal aantal contracturen (uitsplitsing maken naar type contract)
  - Totaal aantal deuren in de terminal
### KPIs

**Table E-1 Resource category, performance category and description KPI**

<table>
<thead>
<tr>
<th>Resource</th>
<th>Performance category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>gebouw</td>
<td>efficiency</td>
<td>Benutting van de terminalvoer tijdens het outboundproces</td>
</tr>
<tr>
<td>gebouw</td>
<td>efficiency</td>
<td>Benutting van de terminaldeuren tijdens het outboundproces</td>
</tr>
<tr>
<td>gebouw</td>
<td>efficiency</td>
<td>Benutting van de sorteermachine tijdens het outboundproces</td>
</tr>
<tr>
<td>gebouw</td>
<td>Efficiency</td>
<td>Efficiëntie van de sorteermachine tijdens het outboundproces</td>
</tr>
<tr>
<td>mensen</td>
<td>efficiency</td>
<td>Benutting van de TH werknemers tijdens het outboundproces</td>
</tr>
<tr>
<td>mensen</td>
<td>efficiency</td>
<td>Benutting van de TH contracturen tijdens het outboundproces</td>
</tr>
<tr>
<td>mensen</td>
<td>Efficiency</td>
<td>Efficiëntie van de TH werknemers tijdens het outboundproces</td>
</tr>
<tr>
<td>mensen</td>
<td>Efficiency</td>
<td>Efficiëntie in de TH contracturen tijdens het outboundproces</td>
</tr>
<tr>
<td>voertuig</td>
<td>efficiency</td>
<td>Benutting van de heftruck- en EPTvloot tijdens het outboundproces</td>
</tr>
<tr>
<td>voertuig</td>
<td>efficiency</td>
<td>Benutting van de heftrucks en EPT's tijdens het outboundproces</td>
</tr>
<tr>
<td>mensen</td>
<td>Flexibility</td>
<td>Flexibiliteit van de TH werknemers tijdens het outboundproces</td>
</tr>
<tr>
<td>mensen</td>
<td>Flexibility</td>
<td>Flexibiliteit in TH werknemers tijdens het outboundproces</td>
</tr>
<tr>
<td>gebouw</td>
<td>Productivity</td>
<td>Productiviteit van het terminal outbound proces</td>
</tr>
<tr>
<td>gebouw</td>
<td>Productivity</td>
<td>Productiviteit van de sorteermachine tijdens het outbound proces</td>
</tr>
<tr>
<td>gebouw</td>
<td>Quality</td>
<td>Kwaliteit van het outbound sorteerproces</td>
</tr>
<tr>
<td>gebouw</td>
<td>Quality</td>
<td>Kwaliteit van het outbound scanproces</td>
</tr>
<tr>
<td>gebouw</td>
<td>Quality</td>
<td>Kwaliteit van het gehele outbound proces</td>
</tr>
</tbody>
</table>

**Table E-2 KPI name and calculation method for pickup process**

<table>
<thead>
<tr>
<th>Performance indicator</th>
<th>Possible calculation method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outbound TH floor utilization</td>
<td>used floor spaces / total floor spaces</td>
</tr>
<tr>
<td>Outbound TH door utilization</td>
<td># routes / # doors</td>
</tr>
<tr>
<td>Outbound TH sorter utilization</td>
<td>Active sorter hours / max sorter hours</td>
</tr>
<tr>
<td>Outbound TH sorter efficiency</td>
<td>operational capacity / actual parts per hour</td>
</tr>
<tr>
<td>Outbound TH personnel utilization</td>
<td>Deployed employees / total employees</td>
</tr>
<tr>
<td>Outbound TH contract hour utilization</td>
<td>Paid personnel hours / (paid + unavailable hours)</td>
</tr>
<tr>
<td>Outbound TH personnel efficiency</td>
<td>Scheduled personnel hours / actual paid hours</td>
</tr>
<tr>
<td>Outbound TH contract hour efficiency</td>
<td>Illness rate</td>
</tr>
<tr>
<td>Outbound TH equipment fleet utilization</td>
<td>Used pieces of equipment / total pieces of equipment</td>
</tr>
<tr>
<td>Outbound TH equipment utilization</td>
<td>hours that equipment is used / max possible hours</td>
</tr>
<tr>
<td>Outbound TH equipment efficiency</td>
<td>(time per movement * movements) / equipment hours</td>
</tr>
<tr>
<td>Outbound TH employee flexibility</td>
<td>Employees with more functions / total employees</td>
</tr>
<tr>
<td>Outbound TH personnel flexibility</td>
<td>DHL employees / total employees</td>
</tr>
<tr>
<td>Outbound TH contract hours flexibility</td>
<td>DHL employees hours / Total employees hours</td>
</tr>
<tr>
<td>Outbound proces productivity</td>
<td>pieces per day</td>
</tr>
<tr>
<td>Outbound sorter productivity</td>
<td>parcels per hour</td>
</tr>
<tr>
<td>Outbound sorter quality</td>
<td>missort rate</td>
</tr>
<tr>
<td>Outbound scan quality</td>
<td>Process compliance</td>
</tr>
<tr>
<td>Outbound process quality</td>
<td>OB origin performance</td>
</tr>
</tbody>
</table>

- **Control and intervene 1:**
  - Realtime aanpassingen doen aan het aantal routes en chauffeurs wanneer dit nodig is.
Transformation 2a – Terminal outbound process
Transformation 2a heeft 2 control loops: een feed forward loop (control loop 2a) en een feed back loop (control loop 2b).
De gegevens die gemeten worden bij control loop 1 (van het pick-up proces) worden gebruikt als feed forward voor control loop 2 [2a]). De measures en standards zijn gelijk. De control en intervene acties zijn echter anders.

De capaciteit van het terminal outbound proces is voor beide control loops gelijk, dus die zal hier eerst behandeld worden:
- Totaal aantal terminal handling medewerkers (uitsplitsing maken naar type contract)
- Totaal aantal contracturen (uitsplitsing maken naar type contract)
- Totaal aantal heftrucks
- Totaal aantal EPT’s
- Totaal vloer oppervlakte geschikt voor het terminal outbound proces
- Capaciteit van de sorteermachine
Figure E-10 Terminal outbound process
Creating Transparency in Resource Utilization and Flexibility of DHL Express NL

Feed forward (loop 2a)
- **Measure a:**
  - Gelijk aan control loop 1
- **Standards a:**
  - Gelijk aan control loop 1
- **Compare a:**
  - Gelijk aan control loop 1
- **KPIs a:**
  - Gelijk aan control loop 1
- **Control and intervene 2 op basis van feed forward:**
  - Het aanpassen van het aantal loodsmedewerkers, op basis van het verschil tussen het voorspelde aantal pakjes en de werkelijke aantallen, indien nodig.

Feed back (loop 2b)
- **Measure b:**
  - Aantal outbound pakjes (per type en service)
  - Aantal vloerplaatsen dat is gebruikt om inkomende pakjes te plaatsen
  - Aantal vloerplaatsen dat is gebruikt om uitgaande pakjes te plaatsen
  - Aantal gebruikte heftrucks
  - Aantal gebruikte EPT's
  - Aantal uren dat de sorteermachine is gebruikt
  - Aantal terminal handling medewerkers voor het outbound proces (per functietype en soort contract)
  - Hoeveelheid pakjes niet in 1x gesorteerd konden worden
  - Tijdstip waarop het pakje is gesorteerd
  - Aantal ziekte/ niet-beschikbare uren
  - Aantal pakjes dat opgehaald wordt door niet-DHL werknemers

- **Standards b:**
  - Validation regulations
  - Sort instructions (inclusief targets)
  - Containerization instructions
  - Loading instructions
  - Targets voor het sorteren

- **Compare b:**
  - Targets vergelijken met de actuele performance. Dit geeft een waarde voor de KPI's.

31 januari 2011
• **KPIs b**

<table>
<thead>
<tr>
<th>Table E-3 Resource category, performance category and description KPI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Resource</strong></td>
</tr>
<tr>
<td>gebouw</td>
</tr>
<tr>
<td>gebouw</td>
</tr>
<tr>
<td>gebouw</td>
</tr>
<tr>
<td>mensen</td>
</tr>
<tr>
<td>mensen</td>
</tr>
<tr>
<td>mensen</td>
</tr>
<tr>
<td>mensen</td>
</tr>
<tr>
<td>voertuig</td>
</tr>
<tr>
<td>voertuig</td>
</tr>
<tr>
<td>mensen</td>
</tr>
<tr>
<td>mensen</td>
</tr>
<tr>
<td>gebouw</td>
</tr>
<tr>
<td>gebouw</td>
</tr>
<tr>
<td>gebouw</td>
</tr>
<tr>
<td>gebouw</td>
</tr>
<tr>
<td>gebouw</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table E-4 KPI name and calculation method for terminal outbound process</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Performance indicator</strong></td>
</tr>
<tr>
<td>Outbound TH floor utilization</td>
</tr>
<tr>
<td>Outbound TH door utilization</td>
</tr>
<tr>
<td>Outbound TH sorter utilization</td>
</tr>
<tr>
<td>Outbound TH sorter efficiency</td>
</tr>
<tr>
<td>Outbound TH personnel utilization</td>
</tr>
<tr>
<td>Outbound TH contract hour utilization</td>
</tr>
<tr>
<td>Outbound TH personnel efficiency</td>
</tr>
<tr>
<td>Outbound TH contract hour efficiency</td>
</tr>
<tr>
<td>Outbound TH equipment fleet utilization</td>
</tr>
<tr>
<td>Outbound TH equipment utilization</td>
</tr>
<tr>
<td>Outbound TH equipment efficiency</td>
</tr>
<tr>
<td>Outbound TH employee flexibility</td>
</tr>
<tr>
<td>Outbound TH personnel flexibility</td>
</tr>
<tr>
<td>Outbound TH contract hours flexibility</td>
</tr>
<tr>
<td>Outbound process productivity</td>
</tr>
<tr>
<td>Outbound sorter productivity</td>
</tr>
<tr>
<td>Outbound sorter quality</td>
</tr>
<tr>
<td>Outbound scan quality</td>
</tr>
<tr>
<td>Outbound process quality</td>
</tr>
</tbody>
</table>

• **Control and intervene 2 op basis van feed back:**
  - Wanneer de processen, die tijdens het terminal outbound proces plaatsvinden, fouten bevatten, kunnen deze worden hersteld door de medewerkers zelf of door de supervisors. Bijvoorbeeld het leeghalen van de goot, als die vollopen doordat er veel pakjes zijn voor 1 bestemming.

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Transformation 2b – Transit process
Het grootste gedeelte van het transit proces, wordt niet door Express beïnvloed, maar is in handen van Freight (voor DDD en DDI) of Hubs & Gateways (voor TD). Daarom is voor dit proces niet een volledige control loop gemaakt, maar is er slechts een lijst van de KPI’s opgesteld. Dit zijn overigens alleen de KPI’s die binnen de invloedssfeer van Express liggen of die consequenties voor Express hebben.

• KPI’s

Table E-5 Resource category, performance category and description KPI

<table>
<thead>
<tr>
<th>Resource</th>
<th>Performance category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>mensen</td>
<td>efficiency</td>
<td>Benutting van de linehaul medewerkers</td>
</tr>
<tr>
<td>mensen</td>
<td>efficiency</td>
<td>Benutting van de linehaul contracturen</td>
</tr>
<tr>
<td>mensen</td>
<td>Efficiency</td>
<td>Efficiëntie in de linehaul contracturen</td>
</tr>
<tr>
<td>mensen</td>
<td>Efficiency</td>
<td>Efficiëntie van de linehaul medewerkers</td>
</tr>
<tr>
<td>voertuig</td>
<td>efficiency</td>
<td>Benutting van de linehaul voertuigen</td>
</tr>
<tr>
<td>volume</td>
<td>Efficiency</td>
<td>Efficiëntie van de linehaul ritten</td>
</tr>
<tr>
<td>mensen</td>
<td>Flexibility</td>
<td>Flexibiliteit van de linehaul werknemers</td>
</tr>
<tr>
<td>mensen</td>
<td>Flexibility</td>
<td>Flexibiliteit in linehaul werknemers</td>
</tr>
<tr>
<td>mensen</td>
<td>Flexibility</td>
<td>Flexibiliteit in de linehaul contracturen</td>
</tr>
<tr>
<td>voertuig</td>
<td>Flexibility</td>
<td>Flexibiliteit van de linehaul voort</td>
</tr>
<tr>
<td>mensen</td>
<td>Quality</td>
<td>Kwaliteit van de linehaul werknemers</td>
</tr>
<tr>
<td>voertuig</td>
<td>Quality</td>
<td>Kwaliteit linehaul service</td>
</tr>
<tr>
<td>voertuig</td>
<td>Quality</td>
<td>Kwaliteit van de linehaul vloot</td>
</tr>
</tbody>
</table>

Table E-6 KPI name and calculation method for transit process

<table>
<thead>
<tr>
<th>Performance indicator</th>
<th>Possible calculation method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linehaul personnel utilization</td>
<td>Deployed employees / total employees</td>
</tr>
<tr>
<td>Linehaul contract hour utilization</td>
<td>Paid personnel hours / (paid + unavailability hours)</td>
</tr>
<tr>
<td>Linehaul contract hour efficiency</td>
<td>Illness rate</td>
</tr>
<tr>
<td>Linehaul personnel efficiency</td>
<td>Scheduled personnel hours / actual paid hours</td>
</tr>
<tr>
<td>Linehaul fleet utilization</td>
<td>Used vehicles for delivery / total suitable vehicles for delivery</td>
</tr>
<tr>
<td>Linehaul vehicle utilization</td>
<td>Loadfactor (used floor spaces / total floor spaces)</td>
</tr>
<tr>
<td>Linehaul network efficiency</td>
<td>Total kms Landelijk Net / Driven kms Landelijk Net</td>
</tr>
<tr>
<td>Linehaul employee flexibility</td>
<td>Employees with more functions / total employees</td>
</tr>
<tr>
<td>Linehaul personnel flexibility</td>
<td>DHL employees / total employees</td>
</tr>
<tr>
<td>Linehaul contract hour flexibility</td>
<td>DHL employees hours / Total employees hours</td>
</tr>
<tr>
<td>Linehaul fleet flexibility</td>
<td>DHL vehicles / total used vehicles</td>
</tr>
<tr>
<td>Linehaul employee quality</td>
<td>Average nr years schadevrij gereden</td>
</tr>
<tr>
<td>Linehaul quality</td>
<td>On time departure linehaul rate</td>
</tr>
<tr>
<td>Linehaul fleet quality</td>
<td>Average % damaged DHL cars</td>
</tr>
</tbody>
</table>

Transformation 2g – Terminal Inbound process
Het terminal Inbound proces begint wanneer de pakjes op de terminals aankomen, aangezien het proces pas hier weer de invloedssfeer van DHL Express binnenkomt. De beladingsgraad van de vrachtwagens vanaf de gateways richting de terminals kunnen niet worden beïnvloed door Express. De beladingsgraad van de DDD ritten is wel meegenomen, omdat dit dezelfde stroom is als de outputstroom van transformatie 2b (het transit proces) is.

De capaciteit van het terminal Inbound proces is voor beide control loops gelijk, dus die zal hier eerst behandeld worden:

- Totaal aantal terminal handling medewerkers (uitsplitsing maken naar type contract)
- Totaal aantal contracturen (uitsplitsing maken naar type contract)
- Totaal aantal hefrucks
- Totaal aantal EPT's
- Totaal vloer oppervlakte geschikt voor het terminal outbound proces
- Capaciteit van de sorteermachine

![Diagram of Terminal Inbound Process](image)

**Figure E-11 Terminal Inbound process**

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Feed forward (loop 3a)

- **Measure a:**
  - Gelijk aan control loop 2b
- **Standards a:**
  - Gelijk aan control loop 2b
- **Compare a:**
  - Gelijk aan control loop 2b
- **KPIs a:**
  - Gelijk aan control loop 2b
- **Control and intervene 2 op basis van feed forward:**
  - Het aanpassen van het aantal loodsmedewerkers, op basis van het verschil tussen het voorspelde aantal pakjes en de werkelijke aantallen, indien nodig.

Feed back (loop 3b)

- **Measure b:**
  - Aantal Inbound pakjes (per type en service)
  - Aantal vloerplaatsen dat is gebruikt om inkomende pakjes te plaatsen
  - Aantal vloerplaatsen dat is gebruikt om uitgaande pakjes te plaatsen
  - Aantal gebruikte heftrucks
  - Aantal gebruikte EPT’s
  - Aantal uren dat de sorteermachine is gebruikt
  - Aantal terminal handling medewerkers voor het Inbound proces (per functietype en soort contract)
  - Hoeveelheid pakjes niet in 1x gesorteerd konden worden
  - Tijdstip waarop het pakje is gesorteerd
  - Aantal ziekte / niet-beschikbare uren
  - Aantal pakjes dat bezorgd wordt door niet-DHL werknemers

- **Standards b:**
  - Unload instructions
  - Decontainerization instructions
  - Sort instructions
  - Targets voor het Inbound terminal proces

- **Compare b:**
  - Targets vergelijken met de actuele performance. Dit geeft een waarde voor de KPI’s.
• KPIs b

Table E-7 Category, performance category and description KPI terminal Inbound process

<table>
<thead>
<tr>
<th>Resource</th>
<th>Performance category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>gebouw</td>
<td>efficiency</td>
<td>Benutting van de terminalvloer tijdens het inboundproces</td>
</tr>
<tr>
<td>gebouw</td>
<td>efficiency</td>
<td>Benutting van de terminaldeuren tijdens het inboundproces</td>
</tr>
<tr>
<td>gebouw</td>
<td>Efficiency</td>
<td>Efficiëntie van de sorteermachine tijdens het inboundproces</td>
</tr>
<tr>
<td>mensen</td>
<td>efficiency</td>
<td>Benutting van de TH werknemers tijdens het inboundproces</td>
</tr>
<tr>
<td>mensen</td>
<td>Efficiency</td>
<td>Efficiëntie van de TH contracturen tijdens het inboundproces</td>
</tr>
<tr>
<td>mensen</td>
<td>Efficiency</td>
<td>Efficiëntie in de TH contracturen tijdens het inboundproces</td>
</tr>
<tr>
<td>voertuig</td>
<td>efficiency</td>
<td>Benutting van de heftruck- en EPTvloot tijdens het inboundproces</td>
</tr>
<tr>
<td>mensen</td>
<td>Flexibility</td>
<td>Flexibiliteit van de TH werknemers tijdens het inboundproces</td>
</tr>
<tr>
<td>mensen</td>
<td>Flexibility</td>
<td>Flexibiliteit in TH werknemers tijdens het inboundproces</td>
</tr>
<tr>
<td>gebouw</td>
<td>Productivity</td>
<td>Productiviteit van de terminal inbound proces</td>
</tr>
<tr>
<td>gebouw</td>
<td>Productivity</td>
<td>Productiviteit van de sorteermachine tijdens het inboundproces</td>
</tr>
<tr>
<td>gebouw</td>
<td>Quality</td>
<td>Kwaliteit van het inbound sorteerproces</td>
</tr>
<tr>
<td>gebouw</td>
<td>Quality</td>
<td>Kwaliteit van het gehele inbound proces</td>
</tr>
<tr>
<td>gebouw</td>
<td>Quality</td>
<td>Kwaliteit van het meten en wegen</td>
</tr>
</tbody>
</table>

Table E-8 KPI name and calculation method for terminal Inbound process

<table>
<thead>
<tr>
<th>Performance indicator</th>
<th>Possible calculation method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inbound TH floor utilization</td>
<td>used floor spaces / total floor spaces</td>
</tr>
<tr>
<td>Inbound TH door utilization</td>
<td># routes / # doors</td>
</tr>
<tr>
<td>Inbound TH sorter utilization</td>
<td>Active sorter hours / max sorter hours</td>
</tr>
<tr>
<td>Inbound TH sorter efficiency</td>
<td>operational capacity / actual parts per hour</td>
</tr>
<tr>
<td>Outbound TH personnel utilization</td>
<td>Deployed employees / total employees</td>
</tr>
<tr>
<td>Inbound TH contract hour utilization</td>
<td>Paid personnel hours / (paid + unavailable hours)</td>
</tr>
<tr>
<td>Inbound TH personnel efficiency</td>
<td>Scheduled personnel hours / actual paid hours</td>
</tr>
<tr>
<td>Inbound TH contract hour efficiency</td>
<td>illness rate</td>
</tr>
<tr>
<td>Inbound TH equipment fleet utilization</td>
<td>Used pieces of equipment / total pieces of equipment</td>
</tr>
<tr>
<td>Inbound TH equipment utilization</td>
<td>hours that equipment is used / max possible hours</td>
</tr>
<tr>
<td>Inbound TH equipment efficiency</td>
<td>(time per movement * movements) / equipment hours</td>
</tr>
<tr>
<td>Inbound TH employee flexibility</td>
<td>Employees with more functions / total employees</td>
</tr>
<tr>
<td>Inbound TH personnel flexibility</td>
<td>DHL employees / total employees</td>
</tr>
<tr>
<td>Inbound TH contract hours flexibility</td>
<td>DHL employees hours / Total employees hours</td>
</tr>
<tr>
<td>Inbound process productivity</td>
<td>Pieces per day</td>
</tr>
<tr>
<td>Inbound sorter productivity</td>
<td>parcels per hour</td>
</tr>
<tr>
<td>Inbound sorter quality</td>
<td>Ms sort rate</td>
</tr>
<tr>
<td>Inbound scan quality</td>
<td>Process compliance</td>
</tr>
<tr>
<td>Inbound process quality</td>
<td>IB destination performance</td>
</tr>
<tr>
<td>Inbound measurement quality</td>
<td>Measure and weight rate</td>
</tr>
</tbody>
</table>

• Control and intervene 2 op basis van feed back:
  o Wanneer de processen, die tijdens het terminal Inbound proces plaatsvinden, fouten bevatten, kunnen deze worden hersteld door de medewerkers zelf of door de supervisors. Bijvoorbeeld het leeghalen van de goot, als die vollopen doordat er veel pakjes zijn voor 1 bestemming.
Transformation 3 — Delivery process
Dit is de laatste transformatie. Hier wordt het pakje van de terminal naar de klant vervoerd en afgeleverd indien dit mogelijk is.

Figure E-12 Delivery process
• **Measures:**
  o Aantal chauffeurs ingezet voor het delivery proces (per type contract en type rit)
  o Tijdspaar route preparation
  o Tijdsduur on route
  o Tijdsduur on tour
  o Tijdsduur debrief
  o Tijdsduur totale werkdag
  o Aantal voertuigen ingezet voor delivery proces (hetzelfde aantal als het aantal chauffeurs als het goed is)
  o Aantal deuren ingezet voor het delivery proces
  o Aantal kilometers gereden per route
  o Lengte per route
  o Aantal pakjes (per type en service)
  o Tijdstip waarop het pakje is weggebracht
  o Hoeveelheid pakjes die niet met de chauffeur meegaan om verschillende redenen
  o Aantal pakjes dat weer mee terug gaat met de chauffeur om verschillende redenen
  o Aantal ziekte/niet-beschikbare uren

• **Standards:**
  o Voorspellingen van het aantal pakjes (per categorie en per service) (buiten systeemgrenzen bepaald)
  o Aantal ingezette DHL medewerkers inclusief aantal uren (binnen systeemgrenzen bepaald)
  o Pick-up procedures
  o Unload instructions
  o Pickup targets

• **Compare:**
  o Targets vergelijken met de actuele performance. Dit geeft een waarde voor de KPI’s.

• **Capaciteit:**
  o Totaal aantal voertuigen (vloot, per type)
  o Totaal aantal chauffeurs voor pick-up (per type contract)
  o Totaal aantal contracturen
  o Totaal aantal deuren in de terminal

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- **KPIs**

**Table E-9 Category, performance category and description KPI delivery process**

<table>
<thead>
<tr>
<th>Resource</th>
<th>Performance category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>volume</td>
<td>Costs</td>
<td>Kostenefficientie</td>
</tr>
<tr>
<td>voertuig</td>
<td>Effectiveness</td>
<td>Effectiviteit van de delivery service</td>
</tr>
<tr>
<td>gebouw</td>
<td>efficiency</td>
<td>Benutting van de delivery terminal deuren</td>
</tr>
<tr>
<td>mensen</td>
<td>efficiency</td>
<td>Benutting van de delivery werknemers</td>
</tr>
<tr>
<td>mensen</td>
<td>efficiency</td>
<td>Benutting van de delivery contracturen</td>
</tr>
<tr>
<td>mensen</td>
<td>efficiency</td>
<td>Benutting van de delivery werkkledij</td>
</tr>
<tr>
<td>mensen</td>
<td>Efficiency</td>
<td>Efficiëntie van de delivery werknemers</td>
</tr>
<tr>
<td>mensen</td>
<td>Efficiency</td>
<td>Efficiëntie in de delivery contracturen</td>
</tr>
<tr>
<td>voertuig</td>
<td>efficiency</td>
<td>Benutting van de delivery voertuigen</td>
</tr>
<tr>
<td>volume</td>
<td>Efficiency</td>
<td>Efficiëntie op de delivery routes</td>
</tr>
<tr>
<td>mensen</td>
<td>Flexibility</td>
<td>Flexibilité van de delivery werknemers</td>
</tr>
<tr>
<td>mensen</td>
<td>Flexibility</td>
<td>Flexibilité in de delivery werknemers</td>
</tr>
<tr>
<td>mensen</td>
<td>Flexibility</td>
<td>Flexibilité in de delivery contracturen</td>
</tr>
<tr>
<td>voertuig</td>
<td>Flexibility</td>
<td>Flexibilité van de delivery voertuigen</td>
</tr>
<tr>
<td>volume</td>
<td>Productivity</td>
<td>Productiviteit tijdens de delivery werkkuren</td>
</tr>
<tr>
<td>volume</td>
<td>Productivity</td>
<td>Productiviteit op de delivery route</td>
</tr>
<tr>
<td>mensen</td>
<td>Quality</td>
<td>Kwaliteit van de delivery werknemers</td>
</tr>
<tr>
<td>voertuig</td>
<td>Quality</td>
<td>Kwaliteit van de delivery voertuigen</td>
</tr>
<tr>
<td>volume</td>
<td>Quality</td>
<td>Kwaliteit van de delivery goederen</td>
</tr>
<tr>
<td>volume</td>
<td>Quality</td>
<td>Kwaliteit van het delivery proces</td>
</tr>
</tbody>
</table>

**Table E-10 KPI name and calculation method for delivery process**

<table>
<thead>
<tr>
<th>Performance indicator</th>
<th>Possible calculation method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delivery costs efficiency</td>
<td>Total costs / total stops</td>
</tr>
<tr>
<td>Delivery service effectiveness</td>
<td>% van de niet afgeleverde goederen</td>
</tr>
<tr>
<td>Delivery terminal door utilization</td>
<td># routes / # doors</td>
</tr>
<tr>
<td>Delivery personnel utilization</td>
<td>Deployed employees / total employees</td>
</tr>
<tr>
<td>Delivery contract hour utilization</td>
<td>Paid personnel hours / (paid + unavailable hours)</td>
</tr>
<tr>
<td>Delivery working time utilization</td>
<td>On route time / Total working time</td>
</tr>
<tr>
<td>Delivery personnel efficiency</td>
<td>Scheduled personnel hours / actual paid hours</td>
</tr>
<tr>
<td>Delivery contract hour efficiency</td>
<td>Illness rate</td>
</tr>
<tr>
<td>Delivery fleet utilization</td>
<td>Used vehicles for delivery / total suitable vehicles for delivery</td>
</tr>
<tr>
<td>Delivery vehicle utilization</td>
<td>Loadfactor (used floor spaces / total floor spaces)</td>
</tr>
<tr>
<td>Delivery route efficiency</td>
<td>Total kms / total stops</td>
</tr>
<tr>
<td>Delivery employee flexibility</td>
<td>Employees with more functions / total employees</td>
</tr>
<tr>
<td>Delivery personnel flexibility</td>
<td>DHL employees / total employees</td>
</tr>
<tr>
<td>Delivery contract hour flexibility</td>
<td>DHL employees hours / total employees hours</td>
</tr>
<tr>
<td>Delivery fleet flexibility</td>
<td>DHL vehicles / total used vehicles</td>
</tr>
<tr>
<td>Delivery working time productivity</td>
<td>SPORH</td>
</tr>
<tr>
<td>Delivery route productivity</td>
<td>SPR</td>
</tr>
<tr>
<td>Delivery employees quality</td>
<td>average nr years schadevrij gereden</td>
</tr>
<tr>
<td>Delivery fleet quality</td>
<td>average % damaged DHL cars</td>
</tr>
<tr>
<td>Delivery goods quality</td>
<td>1-% damaged goods</td>
</tr>
<tr>
<td>Delivery process quality</td>
<td>Process compliance</td>
</tr>
</tbody>
</table>

- **Control and intervene 4 op basis van feed forward:**
  - Voor aanvang nog aanpassingen doen aan het aantal routes en chauffeurs, wanneer uit de gegevens blijkt dat het volume veel hoger of lager is dan geschat.
KPIs for the whole system

Table E-11 Category, performance category and description KPI delivery process

<table>
<thead>
<tr>
<th>Resource</th>
<th>Performance category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bedrijf</td>
<td>Costs</td>
<td>Kosten per beweging</td>
</tr>
<tr>
<td>bedrijf</td>
<td>Costs</td>
<td>Aandeel van de operationele kosten tov de totale kosten</td>
</tr>
<tr>
<td>bedrijf</td>
<td>Effectiveness</td>
<td>Effectiviteit van de DHL service (op tijd afgeleverd)</td>
</tr>
</tbody>
</table>

Table E-12 KPI name and calculation method for whole process

<table>
<thead>
<tr>
<th>Performance indicator</th>
<th>Possible calculation method</th>
</tr>
</thead>
<tbody>
<tr>
<td>OCPM</td>
<td>OCPM</td>
</tr>
<tr>
<td>Percentage operational costs</td>
<td>Operational costs/Total costs</td>
</tr>
<tr>
<td>DHL service effectiveness</td>
<td>% on time deliveries</td>
</tr>
</tbody>
</table>
**PROPER model**

Requirements:
- Volume demand during the year
- Product mix
- Handling times
- Volume per year

Performance:
- OCPM
- Delivery times

**Figure E-13 PROPER model applied for DHL Express NL DD**

The material flow is already explained extensively. The order flow and resource flow are defined for the PROPER model as well. The input of the order flow is the booking. The output is the invoice to the customer. This process is out of scope, so not explained into further detail. The input of the resource flow is the employees, the vehicles, the terminal buildings and the equipment within the terminal buildings. The project mainly focus on the resources. However, this resource flow is not drawn up further. The resources are described in in the SADT figures, as presented in the previous part.

31 Januari 2011
F. Small survey —Answers and questions

The four questions that are asked to the Operations staff managers are:
(These questions are in Dutch, since all the language of communication of the Operations Department is Dutch. The answers are in Dutch as well.) The summary of the questions and answers are discussed in the report in Chapter 6.2.

Questions small survey

1. Wat zijn de doelen die je nastreeft in jouw functie op het gebied van benutting van de middelen (personeel, terminal materieel [heftrucks, pompwagens, etc], voertuigen), efficiëntie van het inzetten van de middelen en de flexibiliteit van het inzetten van de middelen? (Doelen voor de afdeling Operations, niet de persoonlijke doelen)
2. Op welke factoren wordt je afgekend door je direct leidinggevende wat betreft de benutting, efficiëntie en flexibiliteit van de middelen?
3. Op welke manieren grijp je in of kun je ingrijpen, als het resultaat van de factoren waarop je wordt afgekend dreigen te verslechteren in het geval van afnemende hoeveelheid volume? En in het geval van toenemende hoeveelheid volume?
4. Zijn er nog andere factoren die weergeven hoe goed de afdeling Operations presteert in termen van benutting, efficiëntie en flexibiliteit van de middelen, die nu nog niet worden meegenomen? En hoe zijn deze factoren door jou te beïnvloeden?
## Answers small survey

<table>
<thead>
<tr>
<th>Antwoorden van Robert Viegers (Managing Director Operations)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operations doelen</strong></td>
</tr>
<tr>
<td>Optimale service tegen zo laag mogelijke kosten per zending (optimale inzetting van personeel en materiaal)</td>
</tr>
<tr>
<td><strong>Afrekeningsfactoren door direct leidinggevende</strong></td>
</tr>
<tr>
<td>• OCPM</td>
</tr>
<tr>
<td>• Stops per uur</td>
</tr>
<tr>
<td>• Stops per route</td>
</tr>
<tr>
<td>• Uren in warehouse (AM pph en PM pph)</td>
</tr>
<tr>
<td>• Beladingsgraad line hauls</td>
</tr>
<tr>
<td>• Support costs/revenue</td>
</tr>
<tr>
<td><strong>Mogelijkheden tot ingrijpen</strong></td>
</tr>
<tr>
<td>• Flow helpt met correcte planning. Variëren in uren kan door middel van overuren, uitzendkrachten en wel of niet uitgeven van verlof. En door personeel met 0 uren contract wel of niet in te zetten (oproepers)</td>
</tr>
<tr>
<td>• Aankopen of verkopen van voertuigen, heftrucks etc.</td>
</tr>
<tr>
<td>• Nieuwe tourdesigns maken (gebaseerd op volume)</td>
</tr>
<tr>
<td><strong>Andere factoren die niet worden meegenomen nu</strong></td>
</tr>
<tr>
<td>• Belading vliegtuigen en vliegtuigcontainers</td>
</tr>
<tr>
<td>• Bezetting hubs</td>
</tr>
<tr>
<td>Beide niet direct door OPS te beïnvloeden.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Antwoorden van Hans Gernler van Marle (Director Operations)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operations doelen</strong></td>
</tr>
<tr>
<td>• Minimale middelen op het juiste moment op de juiste plaats in technisch betrouwbare staat c.q. voorzien van de juiste training</td>
</tr>
<tr>
<td>• Hoogst mogelijke kwaliteit en betrouwbaarheid in service tegen laagst mogelijke kosten</td>
</tr>
<tr>
<td><strong>Afrekeningsfactoren door direct leidinggevende</strong></td>
</tr>
<tr>
<td>• Operationele kosten</td>
</tr>
<tr>
<td>• Klanttevredenheid</td>
</tr>
<tr>
<td>• Employee satisfaction</td>
</tr>
<tr>
<td><strong>Mogelijkheden tot ingrijpen</strong></td>
</tr>
<tr>
<td>• Bestaande rapportages bij elkaar zoeken en zelf verbanden leggen</td>
</tr>
<tr>
<td>• Analyses doen op daadwerkelijke dan wel vermeende afwijkingen</td>
</tr>
<tr>
<td><strong>Andere factoren die niet worden meegenomen nu</strong></td>
</tr>
<tr>
<td>KPIs die vanuit extern perspectief (klant) de prestatie inzichtelijk maken. Beïnvloeding hiervan hetzelfde als interne KPIs, echter in de bepaling van prioriteiten zouden we met kennis over externe prestaties wellicht andere keuzes kunnen maken</td>
</tr>
</tbody>
</table>
## Antwoorden van Ronald Leunisse (Director Operations)

### Operations doelen
- Optimale inzet van de resources
- Hoogst mogelijke productiviteit tijdens inzet

### Afrekeningsfactoren door direct leidinggevende
- Efficiëntie drukt zich uit in de KPIs voor PUD, TH en support. Deze worden getarget.
- Flexibiliteit en benutting vormen geen onderdeel van de afrekening. Meer onderdeel van process engineering. Dit zou zich moeten uitdrukken in standaardisatiadocument. (Erik en Henrik)

### Mogelijkheden tot ingrijpen
Rapportages tonen de ontwikkeling van de KPIs en de implementatie van standaardprocessen wordt besproken. Voor afwijkende punten worden acties opgesteld. Als dat loopt, zijn impliciet de processen ook voldoende ingericht op volume ontwikkelingen, aangezien de processen (indien standaard), tools (forecasttool) en systemen (FLOW) zijn ingericht om met volume schommelingen om te gaan.

### Andere factoren die niet worden meegenomen nu
- [x]

## Antwoorden van Erik (Director Operations Programs)

### Operations doelen
Doel is zoveel capaciteit (mensen, middelen) beschikbaar te hebben dat de operatie net uitgevoerd kan worden op korte termijn, waarbij het belangrijk is rekening te houden met de forecast op middellange termijn. Het kan hiermee ook zijn om bv lagere benutting nu te hebben als dat nodig is om volgend jaar meer volume te kunnen verwerken (in bv opleiding van mensen, beschikbaar hebben van vloerruimte)

Op dagbasis moet alleen zoveel worden ingezet als tot optimale efficiency leidt. Flexibiliteit op korte termijn is daarmee belangrijk, als ook de mogelijkheid mee te bewegen op volume fluctuaties over jaren (pieken, dalen)

### Afrekeningsfactoren door direct leidinggevende
- Afrekening vindt voornamelijk plaats op basis van kosten per zending. Direct word ik niet afgerekend op benutting, alleen indirect.
- Efficiency is direct zichtbaar in scorecards als productiviteit en wordt nauwlettend gevolgd.
- Benutting en flexibiliteit wordt alleen indirect gemanaged.

### Mogelijkheden tot ingrijpen
- Op langere termijn: sluiten terminal, vacature stops, stilzetten / verkopen voertuigen,
- Op korte termijn: subco stops / inhuur, uitzendkrachten, overuren eigen mensen / vakantieopname,
## Antwoorden van Ruud (Director Network Operations)

**Operations doelen**
- DDD netwerk:
  - zo min mogelijk ULD ritten uitvoeren
  - zoveel mogelijk gebruik maken van bestaande capaciteit
- DDI netwerk:
  - Bypass pickup zo (kosten)efficiënt mogelijk laten verlopen
- TD netwerk:
  - Zo goed mogelijke service bieden. Bij extra kosten, zoveel mogelijk indirect betalen, want dat is goedkoper. Dit betekent zo weinig mogelijk via Schiphol. (maar dus pas als er extra kosten gemaakt moeten worden)

**Afrekeningsfactoren door direct leidinggevende**
- Komt via de kosten tot uitdrukking.
- Voor TD: zorgdragen voor de continuïteit van de kwaliteit door het beschikbaar hebben van capaciteit

**Mogelijkheden tot ingrijpen**
- Loadfactor in de gaten houden in goede tijden. (en ook in slechte tijden voor DDD en DDI netwerk.)
- Volumes van pickups (wanneer het volume van een klant stijgt, miss wel een bypass pickup. Wanneer het volume van een klant daalt, miss wel overgaan tot een normale pickup ipv een bypass pickup)

**Andere factoren die niet worden meegenomen nu**
- Voor DDI staan op eindhoven altijd 2 of 3 extra vrachtwagens standby wanneer opschaling plotseling nodig blijkt. (fysiek op het terrein, of op oproepbasis binnen een hal uur)

## Antwoorden van Armin (Director Operations Deployment)

**Operations doelen**
- Zo weinig mogelijk voertuigen, heftrucks en EPT's

**Afrekeningsfactoren door direct leidinggevende**
- niet

**Mogelijkheden tot ingrijpen**
- Voorstel om meer te verkopen of bijvoorbeeld de buffercapaciteit af te bouwen (of vice versa), bestellingen aanpassen obv laatste ontwikkelingen

**Andere factoren die niet worden meegenomen nu**
- Volgens mij meten we genoeg. We nemen alleen niet veel risico in de planning. De mate van succesvol risico nemen zou ik wel gemeten willen hebben (resultante van over en onder capaciteit). Te veel middelen is net zo slecht als te weinig maar zo wordt in de praktijk niet afgekend.
G. Background information about the feedback sessions

Five feedback sessions took place with the Operations management team. The feedback sessions were of great importance for the definition of the KPIs, the dashboard layout and functionality and the design of scenarios. This appendix describes the feedback sessions by mentioning the most important topics and issues of the meeting.

Session 1:
The first meeting took place on the 12th of October. It aimed to deliver a useful dashboard at the end of the project. The meeting started with the reasons to start this project for those who were not involved yet and to refresh the knowledge of those who already were involved. Furthermore, the project approach that is used to achieve the project objectives is explained in order to clarify the steps that are undertaken and the activities that took place so far are explained. Finally, the expectations about the dashboard and the project are discussed. Figure G-1 show the process that is undertaken to formulate the key performance indicators and the construct the dashboard and the scenarios. The feedback sessions are shown as the iterative improvement process at the bottom of the figure.

![Figure G-1 Process from conceptualization to dashboard design](image-url)
Creating Transparency in Resource Utilization and Flexibility of DHL Express NL

The first session took place at the moment that the draft version of the key performance indicator definitions was ready, since it was aimed to involve the managers as much as possible into this process: these managers are the stakeholders and they are the future users of the dashboard. It is important to include their desires and suggestions into the project. So the second part of the meeting was about the KPIs and their definitions, as the KPIs are discussed one by one.

Issues that are discussed during the meeting are:
- Change of units (for example: floor spaces \( \rightarrow \text{m}^2 \))
- Change of name (for example: working hours \( \rightarrow \text{paid hours} \))
- Division between KLG and GRG must be added (KPI: Utilization route time)
- Change of definition
  - Flex of PuD employees (C drivers / C vehicles)
  - Flex of DHL PuD personnel (paid hours / capacity hours)
  - Flex fleet (numerator and denominator has changed positions)
- New KPIs
  - Utilization GRG vehicles = \( \text{m}^2 \) terminal volume / capacity used vehicle floors
  - Stops per on tour hour
- Addition of 1 sheet with all targets values
- GRG \( \rightarrow \) trucks + tractors (Make the difference between those two)
- Clarify the relation between tractors and trailers

Session 2:
The second meeting took place on the 26th of October. The first item of this meeting was about the definitions as discussed during the first meeting. At the second meeting, the KPI definitions were discussed in more detail, like the aspects that are included in the KPI and the aspects that are excluded.

In the meantime of the first and second meeting, a first draft version was constructed to test the functionality and layout of the dashboard, rather than the results that were presented on the dashboard, since the results were not always based on the aspects that were just discussed during the second meeting.

The main feedback issues were:
- The hierarchy between the KPIs must be clarified. There must be made a distinction between the leading KPIs and the indicative KPIs.
- KPIs on productivity are analysed on a daily basis. The utilization is analysed on a tactical management level, which means that it is not necessary to manage KPIs with an insufficient value immediately. However, the KPI must be a point of attention the coming period. Furthermore, the insufficient result must raise questions about the causes of the insufficient result, which finally leads to measurements.
- With respect to the dashboard usage in the future, it is preferred by the managers to have an overview of all KPI definitions on one sheet of the dashboard, to be able to look up the exact definition of a KPI.
- It is recommended to decide which days are useful to include on a KPI level. For example, the Monday and Friday are relatively uninteresting days for vehicles, while all days are interesting for the personnel KPIs.

Next to these content related issues, the importance of validation is discussed. The validation process started with the discussion of the KPI definitions and the changes as a result of these discussions. Furthermore, the included aspects of the KPIs are discussed.

Session 3:
The third section took place on the 9th of November. The topic of this meeting primarily was the dashboard. Below the main topics are illustrated:

31 januari 2011
The idea to add the forecasts about the volume is discussed. It is interesting to compare the forecasted volume with the actual volume. Unfortunately, there are only budgeted forecasts about volume available at a national level. Those budgeted forecasts widely differ from the forecasts at a terminal level, which is the input for the deployment of vehicles and personnel. The conclusion that could be drawn was that adding the volume would be interesting if these numbers were available, but are less interesting at the moment, since these numbers widely deviate from the real forecasted volumes.

The results of a single month are not enough to discover trends on the medium term. For this reason, it is necessary to have an overview of more than one month. It is preferred by the managers to have an overview of 13 months, which means the past year including the same month last year. This makes it possible to compare the monthly results.

Clarify the aspects that are included per KPI into more detail, since these aspects determine the value of the KPI.

The amount of available doors is changed because of a change in the Inbound and outbound process. Therefore, an e-mail to all terminal managers is sent out after this meeting to find out the actual available amount of terminal doors (for KLG as well as for GRG) and the size of the staging area, to temporary store the pieces before they are loaded into the vehicles.

Report the month on the dashboard, as it is immediately clear which results are showed on the dashboard.

Furthermore, a start is made to discuss the target values, which makes it possible to classify a KPI value.

Session 4:
The fourth meeting took place on the 8th of December. This meeting had three main topics: the dashboard layout, the dashboard results and the scenarios. The main issues of the dashboard layout and the requirements for the scenarios were:

- The KPI names are not clear enough to understand the meaning of the KPI immediately; a description is necessary. Improvement of the KPI names would improve the ease.
- In addition to the weighted average value of a KPI, the terminal with the highest and the terminal with the lowest value are displayed. This is found to be useful by the managers.
- A useful addition would be to show the range of percentages to indicate the zone of a sufficient value.
- A "nice to have" feature would be a graph that display the values of all terminals of one KPI to have a graphic comparison.
- It would be interesting two test two kinds of experiments: first, keep the resources constant and change the volume that must be handled and second, keep the volume constant and change the system (for example: close a terminal, add a terminal).
- Furthermore, the first steps for running scenarios are discussed.

Session 5:
The final meeting took place on the 29th of December. This meeting had two main topics: the results of the current situation and the results of the scenarios. The three main conclusions of the meeting were:

- Broad bandwidth in the utilization and flexibility of the terminals. A possible measure to solve this problem is to move postal code zones from one terminal to another. This action would affect the division of employees and the vehicles very much. It is thus necessary to conduct research to this possibility.
- There is also a broad bandwidth in the utilization of vehicles. A possible solution is to redistribute the vehicles.
- It is difficult to directly draw conclusions from the monthly result. Besides, the dashboard does not give the answers, but is raises questions which are important to manage the right things.
Furthermore, the embedding of the dashboard is discussed. The conclusions concerning the embedding are listed below.

- For the Managing Director and the Ground Operations managers is the dashboard useful to compare terminals based on size, shape and layout. The dashboard offers a new point of view to terminals, also for terminal managers. Mainly the trend of monthly results is important in this case.
- It would be valuable to update the HR and fleet data on a monthly basis as well. It increases the accuracy of the dashboard results and it does not take much time: an update of the fleetlist is already a monthly activity and HR may easily run a query to extract the right data from SAP.
- The Managing Director has accepted the role of dashboard owner.
- The responsibility of a dashboard administrator is assigned to the Operations Programs manager. At the moment, the activity is assigned to the Project Manager Equipment.
H. Intermediate performance indicator lists

This Appendix contains three lists: the initial performance indicators list (long list), derived from the process analysis, the reduced performance indicator list (short list), derived from the selection of the DHL experts and the initial key performance indicators list, which formed the starting point of the feedback sessions with the Operations management team.

Initial performance indicators list (long list)
The definition of the final key performance indicators for the dashboard started with a long list of performance indicators that were assessed by experienced DHL Operations employees.

The list contains performance indicators that give information about performance of resources. Chapter 4 explained the six performance categories. In Chapter 5 were three useful categories selected with respect to resources (efficiency, productivity and flexibility). The category costs is added since this aspect is important and was included in many dashboards, scorecards and in was highlighted in the small survey about performance indicators.

Table H-1 show the initial performance list, the long list. The first column show the process where the performance indicator belongs to, the second show the resource category, the third presents a rough description, the fourth show a possible calculation method and the fifth column show a possible performance indicator name. The category and description field contain information in Dutch, since this list is also presented to the DHL employees in Dutch. This list is equal to all the parts that are showed separately in Appendix E.
## Table H-1 Initial performance indicator list (long list)

<table>
<thead>
<tr>
<th>Sub process</th>
<th>Resource</th>
<th>Performance category</th>
<th>Description</th>
<th>Performance indicator</th>
<th>Possible calculation method</th>
</tr>
</thead>
<tbody>
<tr>
<td>DHL</td>
<td>bedrijf</td>
<td>Costs</td>
<td>Kosten per beweging</td>
<td>OCPM</td>
<td>OCPM</td>
</tr>
<tr>
<td>DHL</td>
<td>bedrijf</td>
<td>Costs</td>
<td>Aandeel van de operationele kosten tov de totale kosten</td>
<td>Percentage operational costs</td>
<td>Operational costs/Total costs</td>
</tr>
<tr>
<td>DHL</td>
<td>bedrijf</td>
<td>Effectiveness</td>
<td>Effectiviteit van de DHL service (op tijd afgeleverd)</td>
<td>DHL service effectiveness</td>
<td>% on time deliveries</td>
</tr>
<tr>
<td>Pickup</td>
<td>volume</td>
<td>Costs</td>
<td>Kostenefficiëntie</td>
<td>Pickup costs efficiency</td>
<td>Total costs / total stops</td>
</tr>
<tr>
<td>Pickup</td>
<td>voertuig</td>
<td>Effectiveness</td>
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<td>Productiviteit tijdens de delivery werkuren</td>
<td>Delivery working time productivity</td>
<td>SPR</td>
</tr>
<tr>
<td>Delivery</td>
<td>volume</td>
<td>Productivity</td>
<td>Productiviteit op de delivery route</td>
<td>Delivery route productivity</td>
<td>SPR</td>
</tr>
<tr>
<td>Delivery</td>
<td>mensen</td>
<td>Quality</td>
<td>Kwaliteit van de delivery werknemers</td>
<td>Delivery employees quality</td>
<td>average nr years schadevrij gereden</td>
</tr>
<tr>
<td>Delivery</td>
<td>voertuig</td>
<td>Quality</td>
<td>Kwaliteit van de delivery vloot</td>
<td>Delivery fleet quality</td>
<td>average % damaged DHL cars</td>
</tr>
<tr>
<td>Delivery</td>
<td>volume</td>
<td>Quality</td>
<td>Kwaliteit van de delivery goederen</td>
<td>Delivery goods quality</td>
<td>1-% damaged goods</td>
</tr>
<tr>
<td>Delivery</td>
<td>volume</td>
<td>Quality</td>
<td>Kwaliteit van het delivery proces</td>
<td>Delivery process quality</td>
<td>Process compliance</td>
</tr>
</tbody>
</table>
Reduced performance indicator list (short list)

The long list is showed to three DHL Experts and they have all made a selection of most important performance indicators. The performance indicators of the long list that were not selected by anyone are removed from the list. The quality and costs performance indicators are removed as well, since this is not in scope of the project. Table H-2 Reduced performance indicator list (short list) shows the short list that is left after the selection of the DHL experts.

<table>
<thead>
<tr>
<th>Sub process</th>
<th>Resource</th>
<th>Performance category</th>
<th>Description</th>
<th>Performance indicator</th>
<th>Possible calculation method</th>
</tr>
</thead>
<tbody>
<tr>
<td>DHL bedrijf</td>
<td>Effectiveness</td>
<td>Effectiviteit van de DHL service (op tijd afgeleverd)</td>
<td>DHL service effectiveness</td>
<td>% on time deliveries</td>
<td></td>
</tr>
<tr>
<td>Pickup bedrijf</td>
<td>Effectiveness</td>
<td>Effectiviteit van de pickup service</td>
<td>Pickup service effectiveness</td>
<td>% van de niet afgehaalde goederen</td>
<td></td>
</tr>
<tr>
<td>Pickup mensen</td>
<td>Efficiency</td>
<td>Benutting van de pickup werknemers</td>
<td>Pickup personnel utilization</td>
<td>Deployed employees / total employees</td>
<td></td>
</tr>
<tr>
<td>Pickup mensen</td>
<td>Efficiency</td>
<td>Benutting van de pickup werktijd</td>
<td>Pickup working time utilization</td>
<td>On route time / Total working time</td>
<td></td>
</tr>
<tr>
<td>Pickup mensen</td>
<td>Efficiency</td>
<td>Efficiëntie van de pickup werknemers</td>
<td>Pickup personnel efficiency</td>
<td>Scheduled personnel hours / actual paid hours</td>
<td></td>
</tr>
<tr>
<td>Pickup mensen</td>
<td>Efficiency</td>
<td>Benutting van de pickup contracturen</td>
<td>Pickup contract hour utilization</td>
<td>Paid personnel hours / (paid + unavailable hours)</td>
<td></td>
</tr>
<tr>
<td>Pickup voertuig</td>
<td>Efficiency</td>
<td>Benutting van de pickup vloot</td>
<td>Pickup fleet utilization</td>
<td>Used vehicles for pickup / total suitable vehicles for pickup</td>
<td></td>
</tr>
<tr>
<td>Pickup mensen</td>
<td>Flexibility</td>
<td>Flexibiliteit van de pickup werknemers</td>
<td>Pickup employee flexibility</td>
<td>Employees with more functions / total employees</td>
<td></td>
</tr>
<tr>
<td>Pickup mensen</td>
<td>Flexibility</td>
<td>Flexibiliteit in de pickup werknemers</td>
<td>Pickup personnel flexibility</td>
<td>DHL employees / total employees</td>
<td></td>
</tr>
<tr>
<td>Pickup mensen</td>
<td>Flexibility</td>
<td>Flexibiliteit in de pickup contracturen</td>
<td>Pickup contract hour flexibility</td>
<td>DHL employees hours / Total employees hours</td>
<td></td>
</tr>
<tr>
<td>Pickup voertuig</td>
<td>Flexibility</td>
<td>Flexibiliteit van de pickup vloot</td>
<td>Pickup fleet flexibility</td>
<td>DHL vehicles / total used vehicles</td>
<td></td>
</tr>
</tbody>
</table>
### Creating Transparency in Resource Utilization and Flexibility of DHL Express NL

<table>
<thead>
<tr>
<th>Sub process</th>
<th>Resource</th>
<th>Performance category</th>
<th>Description</th>
<th>Performance indicator</th>
<th>Possible calculation method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outbound TH</td>
<td>gebouw</td>
<td>Efficiency</td>
<td>Benutting van de terminalvloer tijdens het outboundproces</td>
<td>Outbound TH floor utilization</td>
<td>used floor spaces / total floor spaces</td>
</tr>
<tr>
<td>Outbound TH</td>
<td>gebouw</td>
<td>Efficiency</td>
<td>Benutting van de heftruck- en EPTvloot tijdens het outboundproces</td>
<td>Outbound TH equipment fleet utilization</td>
<td>Used pieces of equipment / total pieces of equipment</td>
</tr>
<tr>
<td>Outbound TH</td>
<td>gebouw</td>
<td>Efficiency</td>
<td>Efficiëntie van de heftrucks en EPT's tijdens het outboundproces</td>
<td>Outbound TH equipment efficiency</td>
<td>(time per movement * movements) / equipment hours</td>
</tr>
<tr>
<td>Outbound TH</td>
<td>mensen</td>
<td>Efficiency</td>
<td>Benutting van de TH werknemers tijdens het outboundproces</td>
<td>Outbound TH personnel utilization</td>
<td>Deployed employees / total employees</td>
</tr>
<tr>
<td>Outbound TH</td>
<td>mensen</td>
<td>Efficiency</td>
<td>Efficiëntie van de TH werknemers tijdens het outboundproces</td>
<td>Outbound TH personnel efficiency</td>
<td>Scheduled personnel hours / actual paid hours</td>
</tr>
<tr>
<td>Outbound TH</td>
<td>gebouw</td>
<td>Efficiency</td>
<td>Benutting van de terminaldeuren tijdens het outboundproces</td>
<td>Outbound TH door utilization</td>
<td># routes / # doors</td>
</tr>
<tr>
<td>Outbound TH</td>
<td>gebouw</td>
<td>Efficiency</td>
<td>Benutting van de sorteermachine tijdens het outboundproces</td>
<td>Outbound TH sorter utilization</td>
<td>Active sorter hours / max sorter hours</td>
</tr>
<tr>
<td>Outbound TH</td>
<td>gebouw</td>
<td>Efficiency</td>
<td>Benutting van de heftrucks en EPT's tijdens het outboundproces</td>
<td>Outbound TH equipment utilization</td>
<td>hours that equipment is used / max possible hours</td>
</tr>
<tr>
<td>Outbound TH</td>
<td>mensen</td>
<td>Efficiency</td>
<td>Benutting van de TH contracturen tijdens het outboundproces</td>
<td>Outbound TH contract hour utilization</td>
<td>Paid personnel hours / (paid + unavailable hours)</td>
</tr>
<tr>
<td>Outbound TH</td>
<td>gebouw</td>
<td>Efficiency</td>
<td>Efficiëntie van de sorteermachine tijdens het outboundproces</td>
<td>Outbound TH sorter efficiency</td>
<td>operational capacity / actual parts per hour</td>
</tr>
<tr>
<td>Outbound TH</td>
<td>mensen</td>
<td>Flexibility</td>
<td>Flexibilitiet in de TH contracturen tijdens het outboundproces</td>
<td>Outbound TH contract hours flexibility</td>
<td>DHL employees hours / Total employees hours</td>
</tr>
<tr>
<td>Outbound TH</td>
<td>gebouw</td>
<td>Productivity</td>
<td>Productiviteit van het terminal outbound proces</td>
<td>Outbound proces productivity</td>
<td>pieces per day</td>
</tr>
<tr>
<td>Outbound TH</td>
<td>gebouw</td>
<td>Productivity</td>
<td>Productiviteit van de sorteermachine tijdens het outbound proces</td>
<td>Outbound sorter productivity</td>
<td>parcels per hour</td>
</tr>
<tr>
<td>Sub process</td>
<td>Resource</td>
<td>Performance category</td>
<td>Description</td>
<td>Performance indicator</td>
<td>Possible calculation method</td>
</tr>
<tr>
<td>-------------</td>
<td>----------</td>
<td>----------------------</td>
<td>-------------</td>
<td>-----------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td>Domestic LH</td>
<td>mensen</td>
<td>Efficiency</td>
<td>Benutting van de linehaul medewerkers</td>
<td>Linehaul personnel utilization</td>
<td>Deployed employees / total employees</td>
</tr>
<tr>
<td>Domestic LH</td>
<td>mensen</td>
<td>Efficiency</td>
<td>Benutting van de linehaul contracturen</td>
<td>Linehaul contract hour utilization</td>
<td>Paid personnel hours / (paid + unavailable hours)</td>
</tr>
<tr>
<td>Domestic LH</td>
<td>mensen</td>
<td>Efficiency</td>
<td>Efficiency van de linehaul medewerkers</td>
<td>Linehaul personnel efficiency</td>
<td>Scheduled personnel hours / actual paid hours</td>
</tr>
<tr>
<td>Domestic LH</td>
<td>voertuig</td>
<td>Efficiency</td>
<td>Benutting van de linehaul vloot</td>
<td>Linehaul fleet utilization</td>
<td>Used vehicles for delivery / total suitable vehicles for delivery</td>
</tr>
<tr>
<td>Domestic LH</td>
<td>voertuig</td>
<td>Efficiency</td>
<td>Benutting van de linehaul voertuigen</td>
<td>Linehaul vehicle utilization</td>
<td>Loadfactor (used floor spaces / total floor spaces)</td>
</tr>
<tr>
<td>Domestic LH</td>
<td>mensen</td>
<td>Flexibility</td>
<td>Flexibiliteit in linehaul werknemers</td>
<td>Linehaul personnel flexibility</td>
<td>DHL employees / total employees</td>
</tr>
<tr>
<td>Domestic LH</td>
<td>mensen</td>
<td>Flexibility</td>
<td>Flexibiliteit in de linehaul contracturen</td>
<td>Linehaul contract hour flexibility</td>
<td>DHL employees hours / Total employees hours</td>
</tr>
<tr>
<td>Domestic LH</td>
<td>voertuig</td>
<td>Flexibility</td>
<td>Flexibiliteit van de linehaul vloot</td>
<td>Linehaul fleet flexibility</td>
<td>DHL vehicles / total used vehicles</td>
</tr>
</tbody>
</table>
Creating Transparency in Resource Utilization and Flexibility of DHL Express NL

<table>
<thead>
<tr>
<th>Sub process</th>
<th>Resource</th>
<th>Performance category</th>
<th>Description</th>
<th>Performance indicator</th>
<th>Possible calculation method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inbound TH</td>
<td>gebouw</td>
<td>Efficiency</td>
<td>Benutting van de terminaldeuren tijdens het inboundproces</td>
<td>Inbound TH door utilization</td>
<td># routes / # doors</td>
</tr>
<tr>
<td>Inbound TH</td>
<td>gebouw</td>
<td>Efficiency</td>
<td>Benutting van de heftruck- en EPTvloot tijdens het inboundproces</td>
<td>Inbound TH equipment fleet utilization</td>
<td>Used pieces of equipment / total pieces of equipment</td>
</tr>
<tr>
<td>Inbound TH</td>
<td>gebouw</td>
<td>Efficiency</td>
<td>Benutting van de heftrucks en EPT's tijdens het inboundproces</td>
<td>Inbound TH equipment utilization</td>
<td>hours that equipment is used / max possible hours</td>
</tr>
<tr>
<td>Inbound TH</td>
<td>mensen</td>
<td>Efficiency</td>
<td>Benutting van de TH werknemers tijdens het inboundproces</td>
<td>Inbound TH personnel utilization</td>
<td>Deployed employees / total employees</td>
</tr>
<tr>
<td>Inbound TH</td>
<td>mensen</td>
<td>Efficiency</td>
<td>Efficiëntie van de TH werknemers tijdens het inboundproces</td>
<td>Inbound TH personnel efficiency</td>
<td>Scheduled personnel hours / actual paid hours</td>
</tr>
<tr>
<td>Inbound TH</td>
<td>gebouw</td>
<td>Efficiency</td>
<td>Efficiëntie van de sorteermachine tijdens het inboundproces</td>
<td>Inbound TH sorter efficiency</td>
<td>operational capacity / actual parts per hour</td>
</tr>
<tr>
<td>Inbound TH</td>
<td>mensen</td>
<td>Efficiency</td>
<td>Benutting van de TH contracturen tijdens het inboundproces</td>
<td>Inbound TH contract hour utilization</td>
<td>Paid personnel hours / (paid + unavaiable hours)</td>
</tr>
<tr>
<td>Inbound TH</td>
<td>gebouw</td>
<td>Efficiency</td>
<td>Benutting van de terminalvloer tijdens het inboundproces</td>
<td>Inbound TH floor utilization</td>
<td>used floor spaces / total floor spaces</td>
</tr>
<tr>
<td>Inbound TH</td>
<td>gebouw</td>
<td>Efficiency</td>
<td>Benutting van de sorteermachine tijdens het inboundproces</td>
<td>Inbound TH sorter utilization</td>
<td>Active sorter hours / max sorter hours</td>
</tr>
<tr>
<td>Inbound TH</td>
<td>mensen</td>
<td>Flexibility</td>
<td>Flexibiliteit in de TH contracturen tijdens het inboundproces</td>
<td>Inbound TH contract hours flexibility</td>
<td>DHL employees hours / Total employees hours</td>
</tr>
<tr>
<td>Inbound TH</td>
<td>gebouw</td>
<td>Productivity</td>
<td>Productiviteit van het terminal inbound proces</td>
<td>Inbound proces productivity</td>
<td>Pieces per day</td>
</tr>
<tr>
<td>Inbound TH</td>
<td>gebouw</td>
<td>Productivity</td>
<td>Productiviteit van de sorteermachine tijdens het inbound proces</td>
<td>Inbound sorter productivity</td>
<td>parcels per hour</td>
</tr>
<tr>
<td>Sub process</td>
<td>Resource</td>
<td>Performance category</td>
<td>Description</td>
<td>Performance indicator</td>
<td>Possible calculation method</td>
</tr>
<tr>
<td>-------------</td>
<td>----------</td>
<td>----------------------</td>
<td>-------------</td>
<td>-----------------------</td>
<td>----------------------------</td>
</tr>
<tr>
<td>Delivery</td>
<td>voertuig</td>
<td>Effectiveness</td>
<td>Effectiviteit van de delivery service</td>
<td>Delivery service effectiveness</td>
<td>% van de niet afgeleverde goederen</td>
</tr>
<tr>
<td>Delivery</td>
<td>mensen</td>
<td>Efficiency</td>
<td>Benutting van de delivery werknemers</td>
<td>Delivery personnel utilization</td>
<td>Deployed employees / total employees</td>
</tr>
<tr>
<td>Delivery</td>
<td>mensen</td>
<td>Efficiency</td>
<td>Efficiëntie van de delivery werknemers</td>
<td>Delivery personnel efficiency</td>
<td>Scheduled personnel hours / actual paid hours</td>
</tr>
<tr>
<td>Delivery</td>
<td>mensen</td>
<td>Efficiency</td>
<td>Benutting van de delivery werktijd</td>
<td>Delivery working time utilization</td>
<td>On route time / Total working time</td>
</tr>
<tr>
<td>Delivery</td>
<td>mensen</td>
<td>Efficiency</td>
<td>Benutting van de delivery contracturen</td>
<td>Delivery contract hour utilization</td>
<td>Paid personnel hours / (paid + unavailable hours)</td>
</tr>
<tr>
<td>Delivery</td>
<td>voertuig</td>
<td>Efficiency</td>
<td>Benutting van de delivery vloot</td>
<td>Delivery fleet utilization</td>
<td>Used vehicles for delivery / total suitable vehicles for delivery</td>
</tr>
<tr>
<td>Delivery</td>
<td>voertuig</td>
<td>Efficiency</td>
<td>Benutting van de delivery voertuigen</td>
<td>Delivery vehicle utilization</td>
<td>Loadfactor (used floor spaces / total floor spaces)</td>
</tr>
<tr>
<td>Delivery</td>
<td>mensen</td>
<td>Flexibility</td>
<td>Flexibiliteit in de delivery werknemers</td>
<td>Delivery personnel flexibility</td>
<td>DHL employees / total employees</td>
</tr>
<tr>
<td>Delivery</td>
<td>mensen</td>
<td>Flexibility</td>
<td>Flexibiliteit van de delivery werknemers</td>
<td>Delivery employee flexibility</td>
<td>Employees with more functions / total employees</td>
</tr>
<tr>
<td>Delivery</td>
<td>voertuig</td>
<td>Flexibility</td>
<td>Flexibiliteit van de delivery vloot</td>
<td>Delivery fleet flexibility</td>
<td>DHL vehicles / total used vehicles</td>
</tr>
<tr>
<td>Delivery</td>
<td>mensen</td>
<td>Flexibility</td>
<td>Flexibiliteit in de delivery contracturen</td>
<td>Delivery contract hour flexibility</td>
<td>DHL employees hours / Total employees hours</td>
</tr>
<tr>
<td>Delivery</td>
<td>volume</td>
<td>Productivity</td>
<td>Productiviteit tijdens de delivery werken</td>
<td>Delivery working time productivity</td>
<td>SPORH</td>
</tr>
<tr>
<td>Delivery</td>
<td>volume</td>
<td>Productivity</td>
<td>Productiviteit op de delivery route</td>
<td>Delivery route productivity</td>
<td>SPR</td>
</tr>
</tbody>
</table>
Initial Key Performance Indicators list

The short list was still too long. Therefore, a research is done to identify the most important aspects per dimension (as mentioned in Chapter 4: performance categories, resource types, process types and locations). All locations are included for express the performance on resources. The selection of aspects of the other dimensions are explained below.

Included performance categories
Included performance categories are utilization (or: efficiency) and flexibility. The efficiency has a company perspective and is linked to costs. Important issues for this category are the capacity requirements of the resources and a fluent operations process. As explained earlier, the term flexibility is a broad term, since it includes many kinds of flexibility. The flexibility that is interesting for this project is the flexibility of the resources. The more flexible the resources are the better a company can adapt to volume changes.

One remark is that the point of view for those categories is different. The utilization presents a number based on data of the operations and therefore presents how well the resources are used in the past, while the flexibility KPIs show the possibilities for the future and indicate if a company is able to react on changes in the future, based on the current type and amount of resources. This is a major difference that must be kept in mind.

The other four performance categories are not included into the project. For each of these categories it is explained why the category is not included in the project.

The categories ‘the ability to control the system’, ‘the quality of work’ and ‘the ability to be innovative’ are left out of scope. The ability to control the system is not relevant for the project, since it will look at the result of the controlled process instead of the process itself. The dashboard that is constructed is the feedback on this result. Concluding, the control mechanisms are left out of scope, but the result of the controlled process is included by means of the dashboard.

The quality depends on the way the operations are performed. But for this project, it is assumed that the quality is satisfying and the goal of this project is not to improve the quality of the operations. The ability to be innovative is out of scope as well, since this is hard to be expressed in terms of utilization.

The categories “effectiveness” and “productivity” are left out of scope as well. The category effectiveness has a customer perspective. It compares what result the customer expects versus what result the company has achieved. An example for DHL is the % of shipments that is delivered on time. Important issues for the effectiveness are the requirements for the product and the satisfaction level of the customer. The performance indicators that measure effectiveness are really useful for the company, but this kind of KPIs are already commonly used at DHL. Furthermore, it is difficult to express the utilization of resources in terms of effectiveness. The productivity is the last one that is left out of scope, since this kind of KPIs is commonly used as well. An example is the amount of pieces that is handled on a daily basis or the amount of stops per hour.

Included processes
From a financial point of view, the PuD process is the most interesting process, since the majority of the OCPM (Operational Costs Per Move) are caused by the PuD process. (DHL Express NL, 2010e) Form a bottleneck point of view, the terminal handling (TH) process is the most interesting process. The bottlenecks for the Inbound process are the floor space and the terminals doors. The sorter and the employees and equipment needed for the sort process are the bottleneck for the outbound process. The terminal is the most inflexible part of the system, since it is easier to arrange a new vehicle of employee than a new building or a redesign of the terminal. The line haul (LH) process is the least interesting part in terms of processes. DHL Express does offer the vehicles and employees, but does not control the line haul network. This makes it more difficult
to influence the process and it therefore is less interesting to put a lot of effort on it. However, the vehicles and employees of the GRG routes also work in during the night for the Benelux net (line hauls). From the processes, only the pickup and delivery process is within the scope of the project. There is another running at the moment that is focused on the terminal handling process, so DHL Express NL has indicated to leave out the terminal handling process. The line haul process is not managed by DHL Express, but by the Freight division. Therefore, the line haul process is not taken into account.

**Included resource types with respect to utilization**

The utilization of personnel is interesting for many reasons. First of all, it is interesting from a financial point of view. It is by far the cost centre with the highest expenses. Another interesting point of view is the future perspective. It is expected that the drivers will be rare in the future. Since the majority of the personnel consist of drivers, this may be a problem for DHL in the future. The utilization of building related resources are an interesting category from a bottleneck point of view. Terminal floor space and terminal doors are a bottleneck for the Inbound process, the sorter is a bottleneck for the outbound process. The terminal equipment is not taken into account, since it is no bottleneck and relatively not an interesting resource from a financial point of view. The fleet is interesting from a financial point of view, since it is the second-most-expensive cost centre of DHL Express. Concluding, all the resource types are taken into account with respect to resource utilization.

**Included resource types with respect to flexibility**

The flexibility of personnel is the most complicated type of flexibility. The personnel of DHL consist of a wide diversity of employees: employees that work a fixed amount of hours a week and employees that work a variable amount of hours a week. Examples of the second category are employees with a 0-hour contract and employees with a min/max contract. Furthermore there are differences in the duration of the contract: some employees have a contract for a certain time period while others have a contract for an indefinite time period. Next to the flexibility in the amount of hours that DHL can deploy his own employees, the company can also choose to hire a subcontractor (subco) or temp labour to deliver and pickup the shipments or to put the pieces on the sorter. The flexibility of the vehicles is less multidimensional. There are three kinds of vehicles that can be used for a route: a DHL vehicle, a vehicle of a subcontractor and a rental vehicle. However, the vehicles are the second most expensive kind of resource. And hiring a rental vehicle or subcontractor is always more expensive than using DHL-owned vehicles. Finally, the flexibility of building related resources is more difficult. The only way to use flexibility for this category of resources is the flexibility of equipment (forklifts and EPTs). The flexibility of a sorter, of terminals doors or of the terminal floor is meaningless to express.

**The chosen aspects combined in one list**

The Performance Indicators list is used as a starting point to construct the Key Performance Indicators out of this list and this short list is used as a starting point for the feedback sessions with the management team. These KPIs are improved according to the requirements and desires of the management team. The final version of the KPIs is discussed in Chapter 8.
### Table H-3 Initial Key Performance Indicator list

<table>
<thead>
<tr>
<th>Key Performance Indicator</th>
<th>Short description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utilization of PuD worked hours</td>
<td>The worked hours as a part of the total paid hours of DHL PuD employees</td>
</tr>
<tr>
<td>Utilization of PuD route time</td>
<td>The on tour time as a part of the total working day of all DHL employees</td>
</tr>
<tr>
<td>Flexibility of PuD employees</td>
<td>The DHL drivers with a C driving license as a part of the total amount of DHL drivers</td>
</tr>
<tr>
<td>Flexibility of PuD personnel</td>
<td>The amount of DHL drivers as a part of all drivers that were deployed</td>
</tr>
<tr>
<td>Flexibility of PuD working hours</td>
<td>The flexible PuD working hours (= subco, overtime, temps, fixed term contracts) as a part of the total PuD working hours</td>
</tr>
<tr>
<td>Utilization of the terminal doors</td>
<td>Used amount of vehicles vs. the total available amount of terminal doors</td>
</tr>
<tr>
<td>Utilization of the terminal floor</td>
<td>Used amount of floor spaces on the terminal floor vs. the total available floor spaces (IB process)</td>
</tr>
<tr>
<td>Utilization of the sorter</td>
<td>Amount of actual parts per sort process as a part of the operational capacity of the sort process</td>
</tr>
<tr>
<td>Utilization of the PuD fleet</td>
<td>Amount of used DHL PuD vehicles as a part of the total amount of DHL PuD vehicles</td>
</tr>
<tr>
<td>Flexibility of the fleet</td>
<td>Total amount of DHL vehicles as a part of the total amount of all deployed vehicles</td>
</tr>
</tbody>
</table>
I. Detailed description of the final key performance indicators

Driving hours of total paid hours
This KPI calculates the tour hours in relation to the total paid hours for all Day Definite drivers. The tour hours are the only productive hours for a driver from a company point of view. The other paid hours consist of accepted non-productive hours (illness, holiday and visits to medical institutions) and unaccepted non-productive hours. An example of the unaccepted non-productive hours is idle time. This is the time that an employee is present but does not have any activities to do.
In the calculation of this KPI are only the DHL employees included, since non-DHL employees get only paid for the worked hours. Therefore, the value for non-DHL employees would always be 100%.

Driving hours of total paid hours = Driving hours of drivers / total paid hours of drivers

Included aspects
- Driving hours: the sum of the ‘pickup & delivery’-process hours plus the sum of the line haul-process hours.
- Total hours: all registered paid hours (pickup & delivery, line haul and non-productive hours)
- Only drivers hours (= no terminal handling hours or other pickup & delivery hours)
- Only DHL drivers

Points of attention
- A very low value: This means that the percentage of driving hours is low in relation to the total paid hours. This is the case when the amount of driving hours is relatively low or the total paid hours relatively high. Causes for this situation are a period of holidays, short working days because of a low amount volume, a high illness rate or a situation that drivers perform relatively many other activities than driving. It is recommended to look deeper into the non-productive hours to find out the cause of the low percentage, since this single number does not say enough about the causes. This information is available at a terminal level.
- A desirable value, but a harmful situation: The situation that the illness rate is high and the hours of overtime are very high at the same time. This may cause stress or at least an undesired situation for the drivers that have many overtime-hours.
- A very high value: The amount of productive hours is (almost) similar to the amount of total paid hours. This means that the drivers do not use their leave of absence or the amount of overtime is extremely high. Both situations can occur for a short time period, but may be harmful for a longer time period, since it causes a high pressure of work.

On tour time of total working time
This KPI calculates the ‘on tour’ time in relation to the total working time of the drivers.
A working day consists of several activities; those are depicted in Figure 1-1. It commonly consists of a route preparation part, an ‘on tour’ part, a break and a debrief part. The ‘on tour’ part is the productive part of the working day, since it is the time period that the drivers are delivering the shipments to the customers are picking up the shipments at the customers.
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The 'on tour' part consists of a STEM IN, on route, a break and a STEM OUT part. The STEM IN and the STEM OUT part are the time from the terminal to the first stop and from the last stop to the terminal respectively. This KPI takes into account the total on tour time of all DHL drivers to calculate the driving hours. However, the break is not included in the total tour time.

<table>
<thead>
<tr>
<th>Route preparation</th>
<th>STEM IN (from terminal to first stop)</th>
<th>On Route</th>
<th>Break</th>
<th>On Route</th>
<th>STEM Out (from last stop to terminal)</th>
<th>Drivers' debrief</th>
</tr>
</thead>
</table>

**Figure 1-1 Different activities of a working day**

There is a difference in the route preparation and debrief processes between the van tours and truck tours. That is the reason why there are two KPIs for the utilization of the 'on route' time.

On tour time of total working time = On tour time / total working time

**Included aspects**
- The STEM IN and STEM OUT time are included in the on tour time.
- The break time is neither included in the total working time nor the on tour time.
- The total working time is the actual working time of the drivers and not the planned working time. The relation between the planned and actual working time cannot be derived from this KPI.
- Only the pickup and delivery process is taken into account. The line haul tours are not included.
- All drivers are included, the DHL employees as well as the non-DHL employees.

**Points of attention**
- A very low value: This means that the route preparation and debrief part form a relatively big part of the working day. One must be aware that this may be caused because the working day was relatively small. Another explanation is that the drivers of a truck tour have done two tours a day. This leads to double route preparation and debrief times, which is unfavourable for the KPI value. It is possible to check the factor 'amount of tours per vehicle', which is also visible on the dashboard.
- A desirable value, but a harmful situation: The value of this KPI cannot be too high, since this means a very high efficiency. However, route preparation and debrief activities are always necessary. One must be aware that a too high percentage can indicate that the pickup and delivery process is not performed well or that the registration is not done carefully. Another undesirable situation is that the drivers make very long working days. The break, route preparation and debrief time will be a small percentage of the total working time. It makes the value of this KPI very high.
- A very high value: This percentage is unrealistic, since it depicts the average value of a whole month. One must look into the more detailed information to look what goes wrong with the PuD process, since a percentage of 100% is not expected in any case.

**Extra worked hours versus contract hours**

The composition of drivers with respect to contract types is very diverse. This KPI calculates how many extra hours are deployed in relation to the fixed contract hours to handle all the shipments. Fixed contract hours are hours that must be paid every month; there is no choice for DHL Express. DHL Express does have a choice to deploy extra hours next to the fixed contract hours; this amount of hours varies every month.

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Extra worked hours versus contract hours = extra worked hours / hours of fixed contracts

The composition of worked hours of DHL drivers is explained in Figure 1-2 and also described in words in Chapter 3. The yellow and orange part form the fixed contract hours; the red part forms the extra worked hours.

**Figure 1-2 Composition of paid hours to DHL drivers**

**Included aspects**

The majority of the drivers have a fixed contract with a fixed amount of hours. Next to these drivers, there are drivers with a fixed-time contract with a fixed amount of hours. (The minimum amount of hours of a min/max contract also belong to this category) DHL must pay these drivers every month. These hours consists of the working hours and leave of absence hours. These hours are depicted by the yellow and orange part of the figure. The orange part of the figure depicts the hours of drivers that will leave DHL within a year, because their fixed-time contract expires or they resign.

Besides, the worked hours of DHL drivers consist of overtime of the fixed hour contract drivers, extra hours of min/max-contract drivers and worked hours of drivers with a 0-hour contract. These three categories form the red part in the figure. The order of layers is totally arbitrary and the types coexist.

The KPI calculates the percentage of the red-part hours in relation to the yellow/orange part.
Potential downsize flexibility
The KPI 'extra worked hours versus contract hours' shows the extra hours of DHL drivers that are deployed. The potential downsize flexibility is not a real KPI, but a factor that shows how many drivers can leave DHL or are going to leave DHL in the coming 12 months. It is preferred by the DHL managers to have this indicator on the dashboard, since it indicates the costs that could be saved in times of low volumes. The orange part of Figure 1-2 depicts the hours of these drivers.

Potential downsize flexibility = the distribution of DHL drivers that can or is going to leave DHL within a time period of a year

The distribution over the year is presented in Figure 1-3.

![Figure 1-3 Example of a distribution of leaving drivers over a year](image)

Included aspects
- All DHL drivers of DHL Express NL Day Definite

C-license drivers versus C-license vehicles
This KPI reflects the flexibility of the drivers group in relation to the amount of vehicles. In more detail: the KPI monitors the drivers with a C driving license in relation to the amount of vehicles that require a C driving license, since the C driving license is the restriction that not every driver can drive every available vehicle.

Section 5.1.3 mentioned the multi-usability factor and also noted that there was no exact definition of the multi-usability of employees. This KPI reflects the multi-usability of drivers, since the C driving license determines if a driver can be flexibly deployed.

On the other hand, this KPI reflects the flexibility of the drivers' deployment on vehicles that require a C driving license. The drivers with a C driving license also work for the line haul process during the night. The tractor-trailer combinations and one type of trucks are used for this process. In order to be able to use the tractor-trailer combinations and trucks in an optimal way, it is required to have two persons per day available per tractor-trailer combination.

C-license drivers versus C-license vehicles = amount of DHL drivers with a C driving license / amount of (only PuD) vehicles that require a C driving license + 2 times the amount of (PuD and LH) vehicles
Included aspects
- Drivers with a C driving license (van-tour drivers and truck-tour drivers)
- Vehicles that require a C driving license (trucks 1 time, tractors and one type of truck 2 times) (van-tour and truck-tour vehicles). The tractors are counted instead of the trailers, since the amount of tractors is lower than the amount of trailers and the tractors are therefore normative. (tractors and trailers)
- There is no distinction between C and CE driving licenses, since this type of data is not available on a country level. Furthermore, it only becomes an important issue if the main truck-tour fleet consists of vehicles that require a CE driving license. Concluding, it is not a problem to leave the distinction between C and CE driving licenses on a tactical management level.

Points of attention
- A very low value: A percentage lower than 100% means that there are fewer drivers available than needed. Vehicles may stay unused because of this drivers' shortage. It is recommended to look at the vehicle utilization to see if this situation occurs.
- A desirable value, but a harmful situation: there are enough drivers that have a C driving license only, but vehicles cannot be used, since they require a CE driving license. The chance that this situation occurs is minimal. However, this KPI can be reviewed in combination with the KPI Utilization GRG vehicles and the volume size (m³) versus total floor space of deployed vehicles and the average tours per vehicle to know more about this possibility.
- A very high value: In case the drivers are all educated by DHL itself, the decision of this issue has already been taken in the past. It is recommended to look at the values of other terminals and offer the drivers the possibility to work for another (nearby) terminal if this (nearby) terminal has a shortage of C drivers.

Pieces delivered by non-DHL employees
Together with the 'on tour time of total working time KPI', this KPI focuses on all drivers deployed by DHL Express Day Definite. It calculates the share of non-DHL activities in terms of delivered pieces. The non-DHL employees are the flexibility part in this KPI. In short: the definition of 'flexible' is different in comparison with the other personnel flexibility KPIs. The non-DHL employees consist of temps (DHL only deploys a not-DHL employee) and subcontractors (DHL deploys a not-DHL employee and not-DHL vehicle). This KPI is related to the flexibility PuD fleet, since the latter is calculated in the same way but for vehicles instead of employees. The KPI values together lead to more information about the composition of non-DHL production means.

Equation:
Pieces delivered by non-DHL employees = \frac{\text{amount of pieces that is delivered by non-DHL drivers}}{\text{total amount of pieces that is delivered}}

Included aspects
- Only the delivered pieces are taken into account, since the picked up pieces are not registered accurate.

Points of attention
- A very low value: This means that there is no flexibility in PuD personnel. This means that DHL has too much PuD employees, if the total amount of delivered pieces will decrease.
- A very high value: This means that there is a high flexibility in the PuD personnel. One must be aware that in general non-DHL employees are more expensive on the long
term, less committed and less productive than DHL employees. It is thus recommended
to look at the KPI 'extra worked hours versus contract hours' first, to conclude if the DHL-
owned drivers are deployed well. If this percentage is relatively high as well and the KPI
'pieces delivered by non-DHL employees' is too high for a longer period of time, it is
recommended to consider hiring new DHL employees.

Utilization # DHL vehicles
DHL has many vehicles. Every day, a certain percentage of those vehicles is used to deliver all the
shipments, based on the amount of shipments and based on the availability of vehicles (because
of absence of vehicles due to maintenance activities). This KPI calculates how many vehicles are
used on average. Since the van tours and truck tours use different vehicles, the utilization PuD
fleet is calculated for the van-tour vehicles and for the truck-tour vehicles. The tractors are
counted twice, since they are used for the line haul process as well, as explained earlier in this
chapter.

Utilization # DHL vehicles = average amount of used DHL vehicles per day / total amount of DHL
vehicles

Included factors
- Number of vehicles per terminals
- Number of used vehicles for the PuD process based on the tour data
- Number of used vehicles for the line haul process based on the line haul data
- Only the Tuesday, Wednesday and Thursday are taken into account, since these days are
  the busiest ones and missing a vehicle on one of these days is not desired. Mondays and
  Fridays are used to maintain and repair vehicles, so if these days were included as well,
  the result would be dirty.

Points of attention
- A very low value: This means that a relatively big part of the vehicles is unused. This can have two causes: the vehicles are not used because there are not enough pieces to deliver or the vehicles cannot be used because they are at the garage for maintenance or repair activities. A third reason can be that not all the tractors are used for the line haul process. It is recommended to consider the fleet composition if the first or third cause is the reason for the low utilization percentage. The KPI 'volume size (m²) versus total floor space of deployed vehicles' and the indicator 'average tours per vehicle' may be useful to conclude if the vehicles are not used because there is not enough volume.
- A desirable value, but a harmful situation: The fleet is well used. However, it is possible that the utilization during the day in comparison with the line haul process differ a lot. In this case, it is recommended to look at the utilizations of the vehicles during the day and during the night and consider a change in the fleet composition when necessary.
- A very high value: A percentage higher than 100% is not possible. However, it is recommended to look at the KPI 'volume size versus total floor space of deployed vehicles' and 'average tours per vehicle' in order to consider buying extra vehicles or deploying extra non-DHL vehicles if these KPI values are high as well.

Volume size (m²) versus total floor space of deployed vehicles
This KPI calculates to what extent the deployed vehicles are used. Van-tour vehicles are left out of
scope for this KPI, since it is not measurable for those vehicles. The surface of the vehicle floor is
used to express the capacity of the vehicle, since it is unusual to pile up the pallets because this
piling process requires more handling time and effort.
Volume size \((m^3)\) versus total floor space of deployed vehicles = total square meters of pieces handled by GRG process / sum of all used vehicle-floor square-meters.

**Included aspects**
- This KPI uses many assumptions. The assumptions concerning the volume mix are commonly used at DHL Express for rough calculations and not specially defined for this project. These assumptions are approved by the management team during the feedback sessions. The assumptions can be found in Appendix 0.
- This KPI uses also some assumptions concerning the capacity of vehicles. These assumptions are approved by the management team during the feedback sessions as well. (See also Appendix 0)

**Points of attention**
- A very low value: A low value means that the trucks that are used are not totally loaded. One must be aware that a low value is not undesirable by definition, since it could be possible that it was preferred to deploy two trucks that are partly loaded instead of one fully loaded truck from an operational point of view. (For example two (groups of) delivery shipments with a relatively small amount of pieces, but geographically wide spread. Another example is that certain tours have many pickup pieces as well.)
- A desirable value, but a harmful situation: This KPI does not show the variety of utilization loading capacity on a tour level. It is possible that some tours have a relatively small amount of parcels and pallets to deliver, while other tours have two fully loaded tours. This can cause an undesirable working situation for the drivers since some drivers have a very low pressure of work, while others have a very high pressure of work.
- A very high value: This means that at least half of the vehicles must drive two tours or must pile up the pallets. It is not difficult by definition, since it can be very efficient if a vehicle has two fully loaded tours; two half loaded tours is less efficient. Besides, this situation can cause a high pressure of work for a driver if this situation occurs for a longer period of time.

One must be aware of another possibility as well: a high value of this KPI may indicate that there are bottlenecks in the total process, for example in the terminal process. In that case, it is recommended to deploy more vehicles, hire more non-DHL vehicles or buy new DHL vehicles.

**Average tours per vehicle**
The average tours per vehicle is a factor, like the 'development personnel downsize flexibility'. This factor is present on the dashboard, since it is useful information for several KPIs. For example, it is useful for the KPI 'Volume size \((m^3)\) versus total floor space of deployed vehicles' when the value is lower than 100%. The factor does not have targets and Points of attention, since it is not a real KPI.

\[
\text{Average tours per vehicle} = \frac{\text{amount of tours}}{\text{amount of used vehicles}}
\]

**Included aspects**
- Only PuD truck tours
- Only used truck-tour vehicles (DHL and non-DHL)
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**Pieces delivered by non-DHL vehicles**
There is no KPI for the flexibility of *DHL vehicles* for several reasons. The most important reason is that it is very difficult to define a desirable value for the share of certain type of vehicles since it depends on many factors, like the composition of the volume, the area characteristics and the long term policy. Most of these factors are out of scope of this project and therefore the flexibility of the DHL fleet is left out of scope as well.
However, the flexibility of *the whole PuD process* can be calculated for all used vehicles as well in the same way it is expressed for the PuD personnel: the share of pieces delivered by non-DHL vehicles as a percentage of the total delivered pieces.
The van-tour / truck-tour split is made for this KPI as well. This KPI is related to the flexibility PuD personnel, since the latter is calculated in the same way but for employees instead of vehicles.
The KPI values together lead to more information about the composition of non-DHL production means. DHL prefers to have DHL personnel on DHL vehicles. Thus, a higher percentage for the flexibility PuD vehicles in comparison with the flexibility PuD employees would be preferable, since this means that there are more non-DHL vehicles than employees: DHL employees will probably drive with rental vehicles in this case.

\[
\text{Pieces delivered by non-DHL vehicles} = \frac{\text{amount of pieces that is delivered by a non-DHL vehicle}}{\text{total amount of pieces that is delivered}}
\]

**Included aspects**
- Only delivered pieces are taken into account, since the picked up pieces are not registered accurate.

**Points of attention**
- A very low value: This means that there is almost no flexibility in vehicles. This means that DHL has too much vehicles, if the total amount of delivered pieces will decrease.
- A very high value: This means that there is a high flexibility in the PuD vehicles. One must be aware that vehicles are mostly more expensive concerning usage than DHL vehicles. When the percentage of this KPI is too high for a longer period of time, it is recommended to consider buying extra DHL vehicles.

**Utilization # terminal doors**
This KPI calculates the usage of doors that are available for the PuD process for the van tours and truck tours separately, since the van-tour PuD process is totally separated from the truck-tour PuD process.

\[
\text{Utilization # terminal doors} = \frac{\text{amount of used vehicles}}{\text{amount of doors available for the PuD process}}
\]

**Included aspects**
- Only the terminal doors that are available for the PuD process are taken into account. (not all terminal doors thus)
- The vehicles that drive two tours a day are counted as one vehicle.
- Only the Tuesday, Wednesday and Thursday are taken into account, like for the KPI 'utilization # DHL vehicles', since they directly influence each other. A fair comparison is impossible then.
Points of attention

- A very low value: This means that a relatively large share of the doors is not used. It is recommended to look at the value of the KPI 'utilization terminal floor GRG Inbound'. If this value is relatively low too, the terminal does not have very much pieces to handle. It is wise then to look at the values of those KPIs for the nearby terminals to judge if the volume of the one terminal could be transferred to the nearby terminal.

Furthermore, it is recommended to look at the values of the KPI 'volume size (m²) versus total floor space of deployed vehicles' and the factor 'average tours per vehicle' and use some extra vehicles if these values are relatively high.

- A desirable value, but a harmful situation: This may occur if the utilization of terminal doors is satisfying, but that the utilization of loading capacity and the average tours of vehicles are relatively low. This probably means that not all vehicles are loaded efficiently and that DHL spends money on fuel unnecessarily.

- A very high value: There are two possibilities when the utilization is 100%: first, all doors are used once per day, this means that growth is difficult but the process is efficient. Second, some doors are used more than once; this may be an indication that the terminal process is less efficient, since this implies a high amount of pieces that must be handled in the terminal. (Exception: there is a planned morning tour and afternoon tour) It is therefore recommended to look at the values for the KPI 'volume size (m²) versus total floor space of deployed vehicles' and the factor 'average tours per vehicle'. High values may imply inefficiency of the terminal handling process.

**Utilization terminal floor GRG Inbound**

This KPI calculates the utilization of the terminal floor of the GRG tour part of the terminal during the Inbound process. Part of the KLG tour vehicles are loaded during the sort process already. The pieces of these tours do not require much floor space. This is the reason why the utilization terminal floor is not included for the KLG part of the terminal. Next to this, the pieces of the outbound process arrive with a more scattered pattern at the terminal than the Inbound process. The Inbound process will therefore be the first bottleneck process. This is the reason why the outbound process is left out of scope for this KPI.

\[
\text{Utilization terminal floor GRG Inbound} = \frac{\text{amount of m}^2\text{ terminal floor used during the GRG Inbound process}}{\text{total amount of available m}^2\text{ terminal floor for an efficient GRG Inbound process}}
\]

**Included aspects**

- Only pieces that are delivered by a truck-tour
- Only pieces that are handled during the Inbound process
- There are assumptions made for some terminal characteristics. For example, the size of the staging area and the amount of parcels and non-conveyables that equal the size of a pallet. The parameters can be found in Appendix 0.

**Points of attention**

- A very low value: This means that the majority of the terminal floor is not used during the Inbound process. It is recommended to look at other purposes for this terminal floor.

- A desired value, but a harmful situation: This situation can occur when the total value per tour differs a lot. It is possible that the amount of volume of one tour exceeds the available staging area and that the staging area of another tour is only filled half.
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- A very high value: This means that the terminal floor for an efficient process is fully used. A 100% value does not mean that the whole terminal floor is used, but that the space available for an efficient loading process is totally used. A 100% value may lead thus to a less efficient process, since pieces must be stacked outside the staging area or must be piled up. Another possibility is that there is not enough space for forklifts to reach every piece. It is recommended to look at the KPI 'utilization terminal doors': a high value of this KPI probably lead to search for possibilities to transfer a part of the pieces to a nearby terminal or to expand the terminal building when possible.

Utilization sorter
This KPI calculates the utilization of the sorter in relation to the available sort window (8 hours). This KPI does not calculate the parts per hour of the active sorter hours, since this is already measured and reported in other overviews. Furthermore, this dashboard is about the utilization of resources and the sorter can be used for a maximum of 8 hours, thus this is the capacity of the sorter.
The Inbound and outbound process of a terminal commonly varies a lot in the amount of pieces that must be handled. This is the reason why the Inbound and outbound processes are separated.

The operational capacity is calculated by 80% of the merge capacity. The merge capacity is the capacity that takes into account more than one infeed position. This implies that the capacity per infeed position is lower.

Utilization sorter = total amount of pieces that must be sorted by the sorter per process / operational capacity of the sorter per process

Included aspects
- Only the pieces that can be sorted by the sorter
- Only the pieces of one process (Inbound or outbound)
- The utilization is calculated by taking the possible sort window and not the actual sort window.
- The KPI used the registered amount of pieces that is sorted during a process. However, it is preferred to use the unique amount of pieces. The difference between the registered amount and the unique amount is that a piece that is scanned more than once, counts for more than once, while every piece counts only once with the calculation of the unique number. At the moment, it is not possible to retrieve the unique amount of pieces from a central database. Retrieving the data from every terminal separately would be very time-consuming. The registered amount of pieces is chosen, since one of the requirements of the dashboard is to keep the maintenance not time-consuming.

Points of attention
- A very low value: This means that there are relatively less pieces that can be sorted with the sorter. It is recommended to think about the financial feasibility with such a low amount of pieces. Furthermore, it is recommended to look at the value of the KPI 'utilization terminal floor' to decide whether the total amount of pieces that must be handled is very low or that it is just the amount of automatically sorted pieces that is low.
- A very high value: This means that there are many pieces that can be sorted automatically. Furthermore, it means that the margin of the sort process is relatively low, which means that there will be a problem if the sorter has a breakdown during the process. It is recommended to look at the value of the KPI 'utilization terminal floor' to decide if the who handling process is almost to its limits or just the sorter.

31 januari 2011
This appendix is completely removed because of confidentiality. The appendix can be requested at Erik van Tol (DHL Express NL)
K. Data sheets and calculation sheets of the dashboard

The dashboard consists of three parts: the data part and the calculation part and the overview part. The overview part is already discussed in Chapter 9. This appendix explains the function and content of the other two parts.

Data part of the dashboard

The data part consists of four sheets, which are presented below:

- A KPI definitions sheet, which contains a description of all KPIs to clarify the meaning of each KPI.
- A parameter sheet, which gives an overview of all the general parameters and terminal specific parameters.
- A target value sheet, which presents the target values for each KPI.
- A logbook sheet to register the follow up actions as a result of the dashboard analysis.
- A downsize flexibility graph, which shows the development of employees of whom the contract is ending.

KPI definitions sheet

The KPIs are carefully defined during an extensive process of feedback sessions. The definitions of the KPIs changed and the names of the KPIs have changed several times as well. It is tried to apply the SMART principle for all KPIs, as explained in Chapter 8. In addition to this carefully performed process, it is useful to have the definitions of the KPIs present in the dashboard for (new) users to look up these definitions. This protects managers from discussions about the real meaning of the KPIs.

The KPI definitions sheet is a simple Excel table with four columns:

- Resource category
- KPI name
- KPI formula
- Short KPI description

The information on this KPI definitions sheet is equal to the information as presented in the previous chapter and it is therefore not included again.

Parameters sheet

The KPIs are calculated by using raw data and parameters. The raw data is explained into more detail in the section 9.4'. There are two kinds of parameters: general parameters and terminal specific parameters. The general parameters have one value for all the terminals, while the terminal specific parameters have different values for different terminals.

Dashboard assumptions

The dashboard assumptions consist of volume assumptions and vehicle assumptions. Below, the two kinds of assumptions are listed.

Volume assumptions

Vehicle assumptions
Terminal characteristics
The terminals have different values for the characteristics below. The characteristics can be divided into the following categories: doors, sorter and floor:

<table>
<thead>
<tr>
<th>Terminal resource</th>
<th>Aspect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doors</td>
<td>Terminal doors KLG</td>
</tr>
<tr>
<td></td>
<td>Terminal doors GRG</td>
</tr>
<tr>
<td>Sorter</td>
<td># infeed positions</td>
</tr>
<tr>
<td></td>
<td>Sorter capacity per infeed</td>
</tr>
<tr>
<td></td>
<td>Theoretical sorter capacity (per hour)</td>
</tr>
<tr>
<td></td>
<td>Merge capacity capacity (per hour)</td>
</tr>
<tr>
<td></td>
<td>Operational capacity (per hour)</td>
</tr>
<tr>
<td></td>
<td># sorter chutes</td>
</tr>
<tr>
<td></td>
<td>Duration sorter window Inbound</td>
</tr>
<tr>
<td></td>
<td>Duration sorter window outbound</td>
</tr>
<tr>
<td>Floor</td>
<td>Surface of the staging area (m²)</td>
</tr>
<tr>
<td></td>
<td>Number of staging areas GRG (# doors GRG)</td>
</tr>
</tbody>
</table>

Target values sheet
The values of the KPIs are assessed based on target values. These target values are created and discussed by the management team during the feedback sessions. A KPI has a desired value if it is between certain values; it then returns a happy smiley and a green box. It is possible that a KPI does not have a desired value by far; it then returns a sad smiley and a red box. The third situation is that the KPI does have a value in between a desired and totally not desired value; it then returns a neutral smiley and an orange box. This system makes it possible to analyse the performance of the system at one glance. This type of valuation is already used in other dashboards and scorecards of DHL Express. Figure K-1 shows this system.

Figure K-1 Symbols that reflect the system condition

Figure K-2 shows the target values sheet. The second level factors do not have a target, since their function is subordinated to the real KPIs. The reasoning of the target values and a bigger figure of the target values are presented in Appendix J.

Logbook sheet
The dashboard also contains a logbook sheet. This sheet is meant for registering the measures that the Ground Operations Managers has taken, that the managers are going to take or for writing down the thoughts when the results of a new month are known. The dashboard can also be used by the Managing Director to monitor the actions of the Ground Operations Managers. The logbook sheet contains several rows:

- Date
- Due date
- Concerned KPI
- Concerned terminal or area
- Concrete action description
- Responsible person
- Responsible person support

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• 0 situation (motivation)
• Result / status (goal achievement)

The concerned KPI and / or terminal are can be chosen from a drop down menu, since the drop down menu prevent writing errors. The action list can be sorted easily, when all the names are equal. The date and due date must also be entered via a prescribed format, for the same reason.

**Downsize flexibility graph**

The factor downsize flexibility graph consists of a graph instead of a value, as explained in Chapter 8. Just a number that display how many employees will leave the company does not give much information. The graph is displayed in a separate sheet of the dashboard file and can be customised: the graph can be used for one terminal at the time or for all terminals together.

![Downsize flexibility graph](image)

**Figure K-3 Example of a distribution of leaving drivers over a year**

**Calculation part of the dashboard**

The calculation part consists of two sheets:
• Results
• Terminal and KPI overview

**Results sheet**

The results sheet contains all the calculations necessary to calculate the KPIs. This sheet is the one that is updated every time the dashboard is updated and it contains many pivot tables to present the processes raw data in the desired manner. Furthermore, the sheet contains tables with calculations that lead to the KPI value. Figure K-4 shows an example for the KPI.
Creating Transparency in Resource Utilization and Flexibility of DHL Express NL

**Figure K-4 Calculations for the KPI C-license drivers vs. C-license vehicles**

**Terminal and KPI overview**
The tab 'Terminal and KPI overview' contains the results for all KPIs and all terminals. This sheet really is an overview sheet. However, it contains so many data, that the data is split up in two clear overview sheets, which are presented in the subsection about overview sheets.

**Figure K-5 Terminal and KPI overview sheet**
L. Raw data fields from sources

There are 5 data sources. From each source, several data fields are retrieved from the source to use for the calculation of the resources. These fields are listed below.

**HR – derived from SAP by the HR department**
- Employee number
- Description (gender)
- Name of the employee
- Surname
- Roepnaam
- Description contract
- Description function
- Start date contract
- End date contract
- Uit dienst
- Description employee sub area (terminal)
- Hours/week
- Description employee area (DHL Express NL)
- Short description (terminal and type of process)

**Fleet – received from the Operations Support Manager**
- License plate
- Fleet number (Every vehicle type has an own fleet number to characterize the vehicle)
- Terminal name
- TD/DD/SD service
- Brand
- Type
- Category DHL (description of characteristics of the vehicle)

**Hours (route information) – derived from the Labor Reporting Tool**
- Entry date
- Facility (terminal)
- Subfacility (DD)
- Route ID (route number)
- Entry route reg category (DHL, other, subco)
- Entry route vehicle type (truck, van)
- Comments (license plate)
- Resource ID name (employee number)
- Start & end route prep (route preparation time)
- Departure from facility
- Start & end break
- Arrival at facility
- Start & end post route (debrief time)
- Delivery and pickup stops
- Delivery and pickup pieces
Hours (other hours) - derived from the Labor Reporting Tool

- Entry date
- Geo view (Operations)
- Area name (Netherlands)
- Facility name (terminal)
- Subfacility name (DD)
- Resource ID name (employee number)
- Entry res ID reg category (DHL, other or subco)
- Reg activity module (PuD, TH, General management, non-standard activities)
- Reg activity name (direct/indirect activities, idle, unavailable)
- User def activity name (activity code)
- Activity start time
- Activity end time
- Activity duration
M. Formulas to convert the raw data into useful dashboard input data

The five Excel files of raw data are all processed in Access and converted into the right input data for the dashboard. In this Appendix, all the conversion formulas are presented. The formulas are ordered by raw data file. First, the formulas for the fleet data are presented, following by the formulas of the HR data, the volume data, the other hour data and the route data. The yellow data fields are the raw data fields.

![Figure M-1 Conversion formulas raw data fleet](image)

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## Table of query HR_4

<table>
<thead>
<tr>
<th>Factor</th>
<th>Calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employee code</td>
<td>Unique employee number</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
</tr>
<tr>
<td>Initials and surname</td>
<td></td>
</tr>
<tr>
<td>Surname</td>
<td></td>
</tr>
<tr>
<td>Roepnaam</td>
<td></td>
</tr>
<tr>
<td>Contract type</td>
<td>fixed-term contract, indefinite contract, min/max contract, etc.</td>
</tr>
<tr>
<td>Function description</td>
<td></td>
</tr>
<tr>
<td>Start date</td>
<td></td>
</tr>
<tr>
<td>End date</td>
<td></td>
</tr>
<tr>
<td>Uit dnst</td>
<td>date that employee is leaving DHL</td>
</tr>
<tr>
<td>Hours / week</td>
<td></td>
</tr>
<tr>
<td>Oms.PersSubgeb.</td>
<td>not useful for this project</td>
</tr>
<tr>
<td>Country</td>
<td></td>
</tr>
<tr>
<td>Cost centre</td>
<td>not useful for this project</td>
</tr>
<tr>
<td>Short description</td>
<td>Terminal and process where employee is active</td>
</tr>
<tr>
<td>Object description</td>
<td>process group where employee is active</td>
</tr>
<tr>
<td>Area</td>
<td>north or south</td>
</tr>
<tr>
<td>Department</td>
<td>Operations</td>
</tr>
<tr>
<td>Terminal abbrev.</td>
<td>Left([Short description];3)</td>
</tr>
<tr>
<td>Capacity in hours</td>
<td>1,2*[Hours / week]</td>
</tr>
<tr>
<td>Contract type def</td>
<td>Type, Parameters_Contract types</td>
</tr>
<tr>
<td>flex/fixed/BT hours</td>
<td>Flex/Fixed/BT hours, Parameters_Contract types</td>
</tr>
<tr>
<td>Terminal name</td>
<td>General code, Parameters_Terminal codes</td>
</tr>
<tr>
<td>Uit dienst time period</td>
<td>ilf(IsNull([Uit dnst]));[flex/fixed/BT hours];DateDiff(&quot;m&quot;;Now();[Uit dnst])</td>
</tr>
<tr>
<td>Flex/Fixed hours</td>
<td>ilf(IsNumeric([Uit dienst time period]);[Uit dienst time period];ilf(IsNull([End date]);[flex/fixed/BT hours];DateDiff(&quot;m&quot;;Now();[End date]))</td>
</tr>
<tr>
<td>Flex / Fixed hours def</td>
<td>ilf((IsNull([End date]) And IsNull([Uit dnst]));[flex/fixed/BT hours];Ilf(([Flex/Fixed hours]&lt;0);&quot;AWAY&quot;;Ilf(([Flex/Fixed hours]&lt;13);&quot;Flex&quot;;&quot;Fixed&quot;))</td>
</tr>
</tbody>
</table>

Figure M-2 Conversion formulas raw data HR
<table>
<thead>
<tr>
<th>Volume</th>
<th>Acces name: Table of query_Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor</td>
<td>Calculation</td>
</tr>
<tr>
<td>Date</td>
<td>Inbound or outbound</td>
</tr>
<tr>
<td>Week</td>
<td>Terminal name with deviating terminal codes</td>
</tr>
<tr>
<td>Process</td>
<td>not useful for this project</td>
</tr>
<tr>
<td>Country</td>
<td>not useful for this project</td>
</tr>
<tr>
<td>Flowcode</td>
<td>A (parcel, N (nonconveyable), P (pallet), L (length goods), D (documents)</td>
</tr>
<tr>
<td>Weight ID</td>
<td>not useful for this project</td>
</tr>
<tr>
<td>Workstation</td>
<td>not useful for this project</td>
</tr>
<tr>
<td>Code</td>
<td>code, only code &quot;TOT&quot; is useful for this project</td>
</tr>
<tr>
<td>Amount</td>
<td>Format(CDate(Format([Date];&quot;0000-00-00&quot;);&quot;dd-mm-yyyy&quot;))</td>
</tr>
<tr>
<td>Flowcode def</td>
<td>If([Flowcode]=&quot;L&quot;;&quot;P&quot;;[Flowcode])</td>
</tr>
<tr>
<td>Date new format</td>
<td>Format(CDate(Format([Date];&quot;0000-00-00&quot;);&quot;dd-mm-yyyy&quot;))</td>
</tr>
<tr>
<td>Day of the week</td>
<td>Weekday([Date new format];2)</td>
</tr>
<tr>
<td>Terminal name</td>
<td>General code, Parameters Terminal codes</td>
</tr>
<tr>
<td>Month</td>
<td>Month: Month([Date new format])</td>
</tr>
</tbody>
</table>

Figure M-3 Conversion formulas raw data volume
Creating Transparency in Resource Utilization and Flexibility of DHL Express NL

<table>
<thead>
<tr>
<th>Factor</th>
<th>Calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENTRY_DATE</td>
<td>Date that data is entered</td>
</tr>
<tr>
<td>GEO_VIEW</td>
<td>OPS</td>
</tr>
<tr>
<td>AREA_NAME</td>
<td>South / North</td>
</tr>
<tr>
<td>FACILITY_NAME</td>
<td>Terminal name</td>
</tr>
<tr>
<td>SUBFACILITY_NAME</td>
<td>DD or TD</td>
</tr>
<tr>
<td>RESOURCE_ID_NAME</td>
<td>Unique employee code and employee name</td>
</tr>
<tr>
<td>ENTRY_RES_ID_REG CATEGORY</td>
<td>DHL, SUBCO or OTHER</td>
</tr>
<tr>
<td>REG_ACTIVITY_MODULE</td>
<td>Concerned process</td>
</tr>
<tr>
<td>REG_ACTIVITY_NAME</td>
<td>Description of performed activity</td>
</tr>
<tr>
<td>USER_DEF_ACTIVITY_NAME</td>
<td>Activity code</td>
</tr>
<tr>
<td>ACTIVITY_START_TIME</td>
<td></td>
</tr>
<tr>
<td>ACTIVITY_END_TIME</td>
<td></td>
</tr>
<tr>
<td>ACTIVITY_DURATION</td>
<td></td>
</tr>
</tbody>
</table>

Activity duration general: \( \left[ \text{ACTIVITY DURATION}\right] \*24 \)

Employee ID: \( \left( \text{Left}[\text{RESOURCE_ID_NAME};7]\right)\*1 \)

Terminal name: General code, Parameters Terminal codes

Activity Code: Code, Parameters Activity codes

Day of the week: Weekday(\(\text{ENTRY_DATE}\);2)

Week number: Format(\(\text{ENTRY_DATE}\);"ww";2;2)

Function: DLookUp("[Function description]";"[Table of query HR 4]";"[Employee code] = " & \[Employee ID]\))

Month: Month(\(\text{Source data Hours}\)\!ENTRY_DATE)

Activity category: Left([Activity code];1)


Flex fixed: DLookUp("[Flex / Fixed hours def]";"[Table of query HR 4]";"[Employee code] = " & \[Employee ID]\))

Figure M-4 Conversion formulas raw data other hours
<table>
<thead>
<tr>
<th>Factor</th>
<th>Calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENTRY DATE</td>
<td>date that data is entered</td>
</tr>
<tr>
<td>FACILITY NAME</td>
<td>terminal name code</td>
</tr>
<tr>
<td>SUBFACILITY NAME</td>
<td>DD or TD</td>
</tr>
<tr>
<td>ROUTE ID</td>
<td>route code</td>
</tr>
<tr>
<td>ENTRY ROUTE_REG CATEGORY</td>
<td>DHL, SUBCO of OTHER</td>
</tr>
<tr>
<td>ENTRY ROUTE VEHICLE TYPE</td>
<td>Van or truck</td>
</tr>
<tr>
<td>COMMENTS</td>
<td>license plate</td>
</tr>
<tr>
<td>RESOURCE ID NAME</td>
<td>unique employee code and employee name</td>
</tr>
<tr>
<td>START ROUTE PREP</td>
<td>point of time</td>
</tr>
<tr>
<td>END ROUTE PREP</td>
<td>point of time</td>
</tr>
<tr>
<td>DEP FROM FACILITY</td>
<td>point of time</td>
</tr>
<tr>
<td>START BREAK</td>
<td>point of time</td>
</tr>
<tr>
<td>END BREAK</td>
<td>point of time</td>
</tr>
<tr>
<td>ARRIVAL FACILITY TIME</td>
<td>point of time</td>
</tr>
<tr>
<td>START POST ROUTE</td>
<td>point of time</td>
</tr>
<tr>
<td>END POST ROUTE</td>
<td>point of time</td>
</tr>
<tr>
<td>DEL STOPS</td>
<td>amount of delivery stops</td>
</tr>
<tr>
<td>PU STOPS</td>
<td>amount of pickup stops</td>
</tr>
<tr>
<td>DEL PCS</td>
<td>amount of delivery pieces</td>
</tr>
<tr>
<td>PU PCS</td>
<td>amount of pickup pieces</td>
</tr>
<tr>
<td>On tour time</td>
<td>(((ARRIVAL FACILITY TIME) - [DEP FROM FACILITY]) - Nz([END BREAK] - [START BREAK]) / 24)</td>
</tr>
<tr>
<td>Total working time</td>
<td>(((END POST ROUTE) - [START ROUTE PREP]) - Nz([END BREAK] - [START BREAK]) / 24)</td>
</tr>
<tr>
<td>Utilization of PuD route time</td>
<td>(((On tour time) / (Total working time)))</td>
</tr>
<tr>
<td>Route type</td>
<td>((\text{ENTRY ROUTE VEHICLE TYPE} = \text{&quot;van&quot;;} \text{&quot;KLG&quot;;} \text{&quot;GRG&quot;}))</td>
</tr>
<tr>
<td>License plate Route</td>
<td>((\text{Case}([\text{COMMENTS}] = 5)))</td>
</tr>
<tr>
<td>Employee code Route</td>
<td>((\text{Left}([\text{RESOURCE ID NAME}] ; 7)))</td>
</tr>
<tr>
<td>Employee group</td>
<td>((\text{Left}([\text{Employee code Route}] ; 2)))</td>
</tr>
<tr>
<td>Employee type</td>
<td>((\text{If}([\text{Employee group}] = 28 ; [\text{Employee group}] = 33 ; [\text{Employee group}] = 34)))</td>
</tr>
<tr>
<td>Unique code</td>
<td>([ENTRY DATE] &amp; [License plate Route])</td>
</tr>
<tr>
<td>Day of the week</td>
<td>((\text{Weekday}([\text{ENTRY DATE}] ; 2)))</td>
</tr>
<tr>
<td>Week number</td>
<td>((\text{Format}([\text{ENTRY DATE}] ; \text{&quot;ww&quot;} ; 2 ; 2)))</td>
</tr>
<tr>
<td>Terminal name</td>
<td>((\text{General code} ; \text{Parameters} ; \text{Terminal codes}))</td>
</tr>
<tr>
<td>LRT subfacility</td>
<td>((\text{LRT subfacility} ; \text{Parameters} ; \text{Terminal codes}))</td>
</tr>
<tr>
<td>Total pieces</td>
<td>((\text{Nz}([\text{DEL PCS}] ; 0) + Nz([\text{PU PCS}] ; 0)))</td>
</tr>
<tr>
<td>Month</td>
<td>((\text{Month} ; \text{Month} ; \text{Source data Route} ; [\text{ENTRY DATE}]))</td>
</tr>
<tr>
<td>Flex / fixed employee</td>
<td>((\text{If}([\text{Employee type}] = \text{DHL} ; \text{DLookUp}([\text{Flex / Fixed hours def}] ; [\text{Table of query HR_4}] ; [\text{Employee code}] = [\text{Employee code Route}] ; \text{&quot;Flex&quot;}))</td>
</tr>
<tr>
<td>Service</td>
<td>((\text{TD/DD/SD} ; \text{Table of query Fleet 2}))</td>
</tr>
<tr>
<td>Employee code Route Numbers</td>
<td>((\text{Employee code Route Numbers} ; \text{Employee code Route}))</td>
</tr>
<tr>
<td>Vehicle owner def</td>
<td>((\text{If}([\text{isNull}([\text{Service}]) = \text{&quot;OUTSOURCED VEHICLE&quot;} ; \text{&quot;DHL VEHICLE&quot;}))</td>
</tr>
<tr>
<td>Capacity vehicle, Route</td>
<td>((\text{If}([\text{Vehicle owner def}] = \text{DHL vehicle} ; \text{DLookUp}([\text{Capacity vehicle}] ; [\text{Table of query Fleet 2}] ; [\text{License plate}] = \text{&quot;&quot;} ; [\text{License plate Route}] = \text{&quot;&quot;} ; \text{&quot;31,2&quot;))</td>
</tr>
<tr>
<td>Fleet group def Route</td>
<td>((\text{If}([\text{Vehicle owner def}] = \text{DHL vehicle} ; \text{DLookUp}([\text{Fleet group def}] ; [\text{Table of query Fleet 2}] ; [\text{License plate}] = \text{&quot;&quot;} ; [\text{License plate Route}] = \text{&quot;&quot;} ; \text{&quot;&quot;))</td>
</tr>
</tbody>
</table>

Figure M-5 Conversion formulas raw data route hours
N. Calculations data set for scenarios

This appendix is about the calculations that must be made to convert the historical data into data which is suitable to run scenarios. Scenarios only use data about the amount of parcels, pallets and non-conveyables. This information is used to calculate the amount of deployed vehicles and deployed employees. Furthermore, some information is provided about the calculations that are made and finally, the scenario coefficients and parameters are presented.

Calculations to determine the amount of deployed vehicles

The calculations start with the amount of parcels, non-conveyables and pallets for a certain period of time. These amounts are a starting point for the calculations. The list below describes the steps that must be executed to get the answers:

- Convert the amount of pieces into the amount of m^2 for all pieces per terminal per day (for KLG and GRG separately), by using the distributions of parcels, non-conveyables and pallets for KLG and GRG.
- Calculate the amount of needed vehicles, by using the average floor surface of a vehicle, the average tours of vehicle (GRG only) and a correction factor. (the latter is explained into more detail later on)
- Check if the amount of DHL vehicles of that terminal is sufficient.
- If not, deploy all DHL vehicles and use non-DHL vehicles for the remaining vehicles.
- If yes, deploy the needed amount of vehicles of the DHL fleet.

Calculations to determine the amount of deployed employee hours

The calculations also start with the amount of parcels, conveyables and pallets for a certain period of time. The list below describes the steps that must be executed to get the answers:

- Calculate the amount of pieces per day by using the amount of parcels, non-conveyables and pallets and the amount of registered days.
- Calculate the amount of pieces per vehicle, by using the deployed amount of vehicles
- Calculate the amount of stops by using the average pieces per stop
- Calculate the total tour hours by using the average stops per tour hours.
- Add the average route preparation and debrief time to the on tour time to calculate the total length of the working day.
- Multiply the total working time per vehicle and the amount of registered days to the amount of deployed vehicles and calculate the total working time in the registered period. (for DHL and non-DHL employees separately)
- Calculate the non-route hours of the DHL employees
- Calculate the line haul working hours by using the amount of line haul vehicles, the average working day for a line haul tour and the amount of registered days.

Simplifications to the calculations

The whole scenario data set is a simplification of the actual situation, except for the amount of parcels, pallets and non-conveyables. However, one issue is worthwhile to discuss separately. The issue is about the bottleneck of the tours per GRG vehicle.

The factor time is the bottleneck for the KLG tours, rather than the available space (m^2). For this reason, a correction factor is introduced to increase the amount of needed vehicles to the same level as the current situation for the situation that all volume factors are 1. This means that the amount of needed vehicles is equal to the current situation. This statement is applicable for all terminals, except for some terminals, since these terminals delivered also Time Definite shipments during the Day Definite tours in the concerned time period (November 2010). Due to this, the terminals needed more vehicles than the amount of vehicles needed for Day Definite shipments.
only. The scenario data set does represent the situation as it is from January 2011, since the operations of the two services are completely separated.

For GRG tours, in general, the bottleneck is the available amount of m² on the vehicle floor. However, in this scenario data set, the assumption is made that the increase in stops is the only incentive that increase the amount of needed vehicles instead of the amount of m². This statement needs some further explanation.

In general, the pickup volume in m² is higher than the delivery volume in m² for GRG tours. This means that the fleet size for GRG is adapted to the needed amount of pickup vehicles in the afternoon and not to the amount of needed vehicles in the morning. This means that the vehicles are only partly loaded, if all vehicles are deployed also during the morning for the delivery process. Furthermore, this means that the GRG drivers are mostly finished with the delivery shipments before the first pickup shipment can be done. Those two phenomena leads to the situation that a growth in the amount of stops can partly be absorbed by the vehicles that are already deployed. (The calculations for the amount of deployed vehicles already include the correction factor like at the KLG tours) The factor that is used to introduce this absorption is the flex factor. This factor is already used for other calculations within DHL reports and dashboards. The assumption that the amount of extra stops is the incentive, rather than the amount of m² is supported by Operations management team. At least for this application this simplification is allowed, since it is not expected by the Operations management team that the growth in efficiency will increase that much that the assumption is not applicable anymore. However, it is recommended to conduct research to the relation between the volume in m² and the amount of stops. This research is not included in this project because of time limits, but it would be interesting to investigate this issue as well in order to make the scenario dashboard more accurate.

**Scenario coefficients and parameters**

The scenario data set makes use of two types of numbers: coefficients and parameters. The coefficients are the numbers that are used to calculate the deployed amount of vehicles and employees, the parameters are the numbers that can be varied to develop different scenarios.

Table N-1 shows the coefficients and the parameters. This list is divided into three parts: personnel, vehicles and volume. The terminal specific coefficients are displayed at a separate sheet in the Excel file. Some of these numbers are calculated based on historical data of one month or one year, like the share of parcels (A), pallets (P) or non-conveyables (N). Others are defined by DHL Express NL employees, like the amount of colli (parcels) per floor space or the percentage of KLG with GRG. Finally, some data originates from other DHL source documents, like the relation between trucks and trailers, which is calculated based on the fleet list.

Table N-1 Scenario coefficients and parameters