



**LUND INSTITUTE OF TECHNOLOGY**

Lund University

*Department of Industrial Management and Logistics  
Division of Production Management*

# **Improving the Haldex Way Tier model**

Using the lean philosophy to achieve business excellence

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## Preface

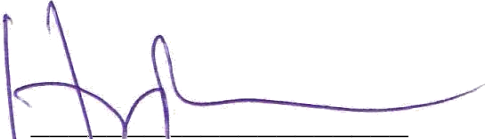
This master's thesis was conducted during the summer of 2010 and represents the final part of our four and half year long Mechanical Engineering master's degree at Lund Institute of Technology, Lund University. The thesis was initiated by Haldex in order to get a fresh set of eyes to conduct a full review of their overall management philosophy's implementation tool.

It truly has been an intense, fun and challenging period for us and we would like to take this opportunity to express our gratitude towards you who have provided us with your fullest support.

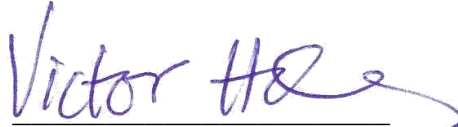
First of all thank you Johan Walette, supervisor at Haldex, for you tremendous support, patience, time and effort. Also, a big thanks to our steering committee at Haldex, Mary Murphy, Rich Dombeck, Francis Oswald, Monica Bellgran and Per Ericson for our many interesting discussions providing constructive thoughts and insights. Thank you Bertil I Nilsson, supervisor at Lund Institute of Technology for your excellent guidance.

We would also like to thank all of you who have helped us during our site visits, with an extra thanks going to Kjersti Rogneflåten, for your brilliant arrangements during our visit in Birmingham.

Lund, 2010-09-29



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## Abstract

**Title:** Improving the Haldex Way Tier model – *using the lean philosophy to achieve business excellence*

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**Background:** Increasing cost effectiveness and productivity are key issues for Haldex. These improvements are obtained through Haldex Way, the overall management and process improvement framework. Haldex Way's deployment, progression and assessment are based on a five level Tier model, the concern with Haldex Way Tier model is that its evolution has been inconsistent and the Tier levels have been added gradually. A full review is therefore needed.

**Purpose:** The purpose of this Master's Thesis is to conduct a full review of the existing Haldex Way Tier model, redesign it, and present an improved Tier model.

**Problem definition:** The analysis should take a holistic view and include the following aspects:

- Structure of the current Tier model
- Functionality for different parts of the business
- Coherence of scope and requirements for the different Tier levels

The reviewed model should follow a logic pattern with coherent steps and support the adding of a Business Excellence model as a fifth level.

**Method:** In this thesis a Systems approach with a qualitative grip was used to capture complex interrelations and ensure a holistic perspective. Data was gathered through a thorough literature study, observations including several site visits, content analysis, benchmarking against Volvo Production System and extensive

interviews. Analysis and redesign of the Tier model were conducted gradually in a loop structure.

**Conclusion:**

The analysis and redesign of the current Tier model have resulted in an improved Tier model, that is more generic and consequently provides added functionality for the different parts of Haldex' businesses. The improved Tier model has a better structure and provides coherence of scope and requirements for the different levels.

**Keywords:**

Lean, Business Excellence, Haldex Way, EFQM, Malcolm Balridge, MBQNA.

## Glossary and Acronyms

<b>Business Excellence models</b>	Models adopted by the Global Excellence Model Council, such as the Malcolm Baldrige National Quality Award (MBNQA) and the EFQM Excellence Model.
<b>Category</b>	All criteria found in the Haldex Way Tier model is categorized into categories to provide a better overview and structure, these are popularly called just “categories”.
<b>Challenge</b>	Audits against the Haldex Way Tier model are called “challenges” as this term is more motivational and positive than “audit”.
<b>Criteria</b>	Refer to norms or standards that a site’s performance is being assessed against in the Haldex Way Tier model.
<b>KPI</b>	Key Performance Indicator, a measure of the performance of a site or process. Ensures that an organization is making progress towards its long-term organizational goals.
<b>LDMS</b>	Lean Daily Management System, a structured recurring meeting format designed to enhance the efforts of an intact work group and increase the speed of continuous improvements.
<b>Standards</b>	Refer to documents developed by Haldex providing standardized procedures, training material, floor marking standards etc.
<b>Structure (horizontal)</b>	The horizontal structure concerns the structure of categories and their progression over the Tier levels.
<b>Structure (vertical)</b>	The vertical structure regards the structuring of the criteria inside each category.
<b>Tier level</b>	Tier levels refer to the Copper, Bronze, Silver, Gold and Platinum challenges of the Haldex Way Tier model.
<b>Tier model</b>	Haldex Way’s deployment, progression and assessment is based on a five level Tier model that supports each site’s progression towards business excellence.

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## 1 Introduction

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*This opening chapter is intended to provide the reader with an introduction to Haldex, Haldex Way and the Tier model. The problem is described and defined and the purpose of the thesis is presented together with the objectives and limitations. Finally, the outline of the report is given.*

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### 1.1 Haldex<sup>1</sup>

Haldex is a provider of proprietary and innovative solutions to the global vehicle industry, with focus on products in vehicles that enhance safety, environment and vehicle dynamics. Haldex has three divisions: Commercial Vehicle Systems (58% of Group sales), Hydraulic Systems (26%) and Traction Systems (16%). Haldex has a global market presence with, in total 23 production sites found in Sweden, Germany, UK, Hungary, USA, Mexico, Brazil, India and China. In 2009 Haldex had a turnover of 5.6 bn SEK and employed 4,281 people. The Haldex Group's sales in 2009 derived 47% from North America, 43% from Europe and 10% from other markets. However, the markets in South America and Asia, foremost China, are growing robustly and their importance to the Group is increasing rapidly.

Haldex aims to contribute to social development by providing vehicle technology that satisfies customers and society. Haldex' mission is:

*“Haldex provides proprietary and innovative technology solutions that improve safety, the environment and vehicle dynamics to the global vehicle industry within specific niches.”*

Haldex aims to strengthen its competitiveness and develop long-term customer relationships by providing products that offer high performance and low total costs for the customer throughout the product's service life. Haldex' vision is:

*“Haldex will be the global vehicle industry's first choice as a long-term partner.”*

By staying on the cutting edge of technology and developing skilled and motivated employees, Haldex aim to achieve profitable growth. Haldex' core values are:

- *Customer first*
- *Respect for the individual*
- *Elimination of waste*

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<sup>1</sup> Haldex Annual Report 2009.

### 1.1.1 Haldex Way

Increasing cost effectiveness and productivity are key issues for Haldex in order to capitalize on its excellent growth potential.<sup>2</sup> In order to improve these key issues, Haldex Way, the overall management and process improvement framework, has been used since the beginning of the 21<sup>st</sup> century. Haldex Way is an overall management philosophy for the entire value chain and has its roots in the Lean production philosophy. It focuses on customer satisfaction and world-class production. The goal is to create a continuous flow between customers, product development, subcontractors and production. The concept of Haldex Way is based on the three core values, customer first, respect for the individual and elimination of waste.

#### 1.1.1.1 The Tier model

Haldex Way today is very extensive and embodies Key Performance Indicators (KPIs), standards, models, methods, team-building activities, educational material etc., but its deployment, progression and assessment is based on a five level Tier model that supports each site's progression towards business excellence.

The Tier model currently consists of four levels; Copper, Bronze, Silver and Gold. Successively, each step consists of a large set of criteria and KPIs that need to be met for the site to reach that specific level. The first two steps, Copper and Bronze, are relatively prescriptive, Silver is slightly wider and Gold takes a considerably wider approach. As the first site is soon ready to take the next step a Platinum Challenge will be added shortly. The concepts of this final step are just being finalized. The Platinum level will use a Business Excellence model<sup>3</sup> as a basis for a never-ending journey towards world-class, see Figure 1.1.



Figure 1.1, Illustration of the Haldex Way Road.<sup>4</sup>

<sup>2</sup> Haldex Annual Report 2009.

<sup>3</sup> Global Excellence Model Council, <http://excellencemodels.org/>, viewed on 20 May 2010.

<sup>4</sup> Booklet by Dantoft et al., The Haldex Way, 2nd ed. 2006.

## 1.2 Problem description

The concern with Haldex Way is that its evolution has been inconsistent and the Tier levels have been added gradually, see Section 3.4.1. This has resulted in that new principles and tools are introduced in the higher levels of the Tier model that have not been touched upon in the lower levels. The manner in which the Tier model has evolved, resulting in differences in scope and requirements for the Tier levels, has led to highly incoherent progression and implementation time between the Tier levels. Not starting to work with a certain principle or tool until that specific level is approached could result in years of implementation time before the site is ready to meet that challenge. A review is therefore needed for the first four levels of the Tier model in order to resolve these issues and align the levels to the introduction of the Business Excellence model as a fifth level, mitigating the risk of the same thing happening again.

## 1.3 Purpose

The purpose of this master's thesis is to conduct a full review of the existing Haldex Way Tier model, redesign it, and present a new and improved Tier model. The analysis should take a holistic view and include the following aspects:

- Structure of the current Tier model
- Functionality for different parts of the business
- Coherence of scope and requirements for the different Tier levels

The improved model should follow a logic pattern with consistent step lengths and support the adding of a Business Excellence model as a Platinum level.

### 1.3.1 Delimitations

In the review, focus is on the Tier levels; Copper, Bronze, Silver, and Gold. Functionality of the model in different parts of the business is only to be analyzed from a generic/specific perspective and standard documents, tools, etc. that are integrated in the Tier model are not to be updated by us. Neither has the analysis of specific KPIs been a focus for this thesis as they are perceived as working satisfactory.

### 1.3.2 Objective

The objective of this master thesis can be condensed to the form of two major goals, which can be divided into separate sub goals:

#### 1. A full review of the existent Tier model

- 1.1. Coherence of scope and requirements between the first four levels by reviewing categories and links, with the objective to create a better guidance for site progression in utilization of lean tools and methodologies.
- 1.2. Support for the Business Excellence model being added as a fifth level.
- 1.3. Functionality in different parts of the business, with the focus to create a good balance in the generic/specific split.

#### 2. An improved Tier model

- 2.1. Resulting in four improved Tier Challenge documents concerning the Copper, Bronze, Silver, and Gold Tier levels.
- 2.2. An introduction, in the form of presentation material and an article, to the improved Tier model.

## 1.4 Outline of the report

The report follows a logical and structured format, every chapter is introduced with a brief summary of the chapter's content and intent. The outline is presented below:

- Chapter 1, *Introduction*, is an introductory chapter providing an insight to the problem definition, the purpose and objectives of the thesis and the outlines of the report.
- Chapter 2, *Methodology*, describes the methodology used throughout the thesis including methods of collecting data, analysis and redesign.
- Chapter 3, *Frame of Reference*, provides a foundation of the underlying concepts and ideas included in the thesis; Lean production, Business Excellence models, Change management and Organizational learning. Also, an comprehensive introduction to Haldex Way is given.
- Chapter 4, *Empirical study*, will give a thorough description of the Tier model sufficient to understand the full context of the study.
- Chapter 5, *Analysis*, in this chapter the analysis of the current Tier model is presented. The analysis is based on the information in the frame of reference and empirical chapters and it is conducted with the help of the frameworks presented in the methodology chapter.
- Chapter 6, *Result*, in this chapter the major parts of the redesign of the current Tier model will be covered. The redesign process has been conducted according to the improvement goals set in the analysis and the guidelines that are presented.
- Chapter 7, *Discussion and future work*, discussions and reflections regarding choice of methodology is presented together with actions for implementation. Finally, our recommendations for future work are presented.
- References
- Appendices

## 2 Methodology

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*This chapter introduces the research methodology followed throughout the thesis, the choice of methodology is clarified and the benefits of providing a holistic approach are discussed. Further, the different approaches of collecting data are explained and the credibility of the data is argued.*

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### 2.1 Scientific approach

In order to make a detailed but still coherent review of the Haldex Way Tier model we have realized the need for a holistic approach. All different aspects of the model, stretching from specific tools to core values and principles cannot be analyzed one by one but rather they must be seen as a system where all parts are interlinked. One way of assuring a holistic approach is by using the Systems approach, in which “the world must be understood in terms of mutually dependent components, as a system with parts, links, goals and feedback mechanisms”.<sup>5</sup>

In order to come to this conclusion we have studied the three different approaches in the Arbner and Bjerke framework, see Table 2.1.

#### 2.1.1 Analytical approach

From the analytical approach perspective there is an objective reality in which patterns and casual relations can be investigated and revealed. The researcher should stay outside the research object and refrain from interacting with it in order to avoid exerting an influence and hence distort the reality he or she is trying to disclose. The basic assumption using this approach is that the world can be analytically decomposed into small elements and that each element can stand alone. Researchers should therefore, in order to approach reality methodologically, decompose reality into the smallest possible elements, transform these elements into concepts and finally try to reveal cause-effect relations by hypothesis testing.<sup>6</sup>

#### 2.1.2 Systems approach

Seeing the world from a systems approach, dividing reality into parts is meaningless. According to the systems theory the world must be understood in terms of mutually dependent components, as a system with parts, links, goals and feedback mechanisms. The entire system is considered to differ from, and is often more, than the sum of the parts and the search for an absolute truth is hence replaced by the search for a problem solution that works in practice. The matter-of-factness, referred to as pragmatism, of the approach implies that the researcher should be very close to the research object. He or she should if possible influence the object as the primary purpose of systems research is to improve systems in practice.<sup>7</sup>

#### 2.1.3 Actors approach

The actors approach provides a completely different view of the reality compared to the analytical or systems approach. With this perspective, reality is not objective, but rather the result of various social constructions. Reality is seen as a construction and knowledge is perceived as socially constructed, which means that knowledge creation depends on the researcher’s interpretation. This approach is highly dependent on context and argues that it

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<sup>5</sup> B. Gammelgaard, ‘Schools in logistics research: A methodological framework for analysis of the discipline’, *International Journal of Physical Distribution & Logistics Management*, 2004.

<sup>6</sup> Ibid.

<sup>7</sup> Ibid.

is impossible to make predictions based on external cause-effect-relations. Ideally the researcher should, in order to understand the object, be part of the research reality and construct the future from within.<sup>8</sup>

**Table 2.1. The Arbnor and Bjerke framework.<sup>9</sup>**

	<b>Analytical approach</b>	<b>Systems approach</b>	<b>Actors approach</b>
<i>Theory type</i>	Determining cause-effect relations. Explanations, predictions. Universal, time and value free laws	Models. Recommendations, normative aspects. Knowledge about concrete systems	Interpretations, understanding. Contextual knowledge
<i>Preferred method</i>	Quantitative, (qualitative research only for validation)	Case studies (qualitative and quantitative)	Qualitative
<i>Unit of analysis</i>	Concepts and their relations	Systems: links, feedback mechanisms and boundaries	People - and their interaction
<i>Data analysis</i>	Description, hypothesis testing	Mapping, modelling	Interpretation
<i>Position of the researcher</i>	Outside	Preferably outside	Inside - as part of the process

Throughout the thesis a systems approach with influences from the actors approach have been used. The systems approach gives us a holistic perspective and the influences from the actors approach make sure that we do not miss out on the social constructions and the subjective views that can influence any system.

## 2.2 Research methods

“Research methods are the data collection techniques which refer to the specific, fact-finding procedures that yield information about the research phenomenon.”<sup>10</sup> Reviewing the Haldex Way Tier model, we found that an appropriate method had much in common with what has been discussed in the research field concerning logistics. Our review is interdisciplinary due to the wide range of components in the model and there is a need for a holistic approach in order to deliver superior results. This means our review will have much in common with the interdisciplinary issues in logistics research and hence such methods will be appropriate for us to use. This approach will be discussed below.

### 2.2.1 Quantitative vs. qualitative research

Research methodologies normally range from the two extremes of scientific (quantitative) research styles to the more constructive (qualitative) styles. Quantitative research styles are objective, scientific, and often incorporate statistical elements designed to quantify the extent to which certain phenomena behave or respond to stimuli in specified ways. Quantitative research methodology however, often gets criticized for the fact that information can be

<sup>8</sup> B . Gammelgaard, ‘Schools in logistics research: A methodological framework for analysis of the discipline’, 2004.

<sup>9</sup> Ibid.

<sup>10</sup> Frankel *et al.*, ‘The white space of logistics research’, *Journal of Business Logistics*, 2005.

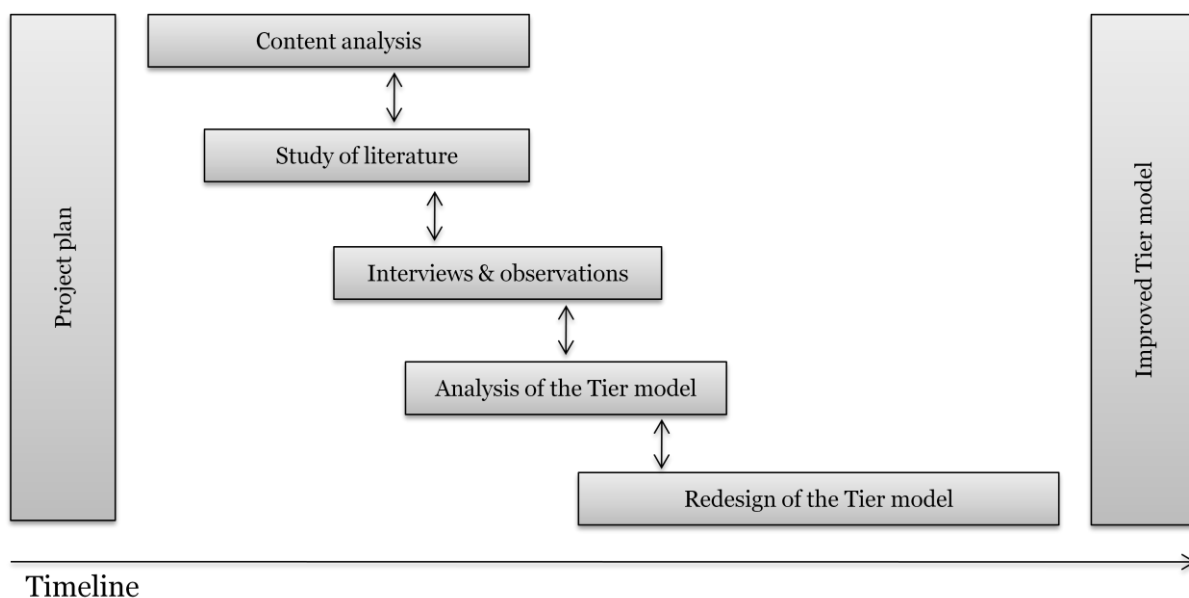
clouded by the complexity of accompanying methods, the large sample sizes needed, and the difficulty in understanding and interpreting results.<sup>11</sup>

Qualitative research styles on the other hand use a more subjective, interpretive, and more constructive style. A qualitative research approach states that the world is essentially relativistic and thus one must understand it from the inside rather than the outside.<sup>12</sup> The word qualitative also implies an emphasis on processes and meaning. Qualitative researchers believe they can get close to the actor’s perspective through detailed interviewing and observations and hence are more likely to confront the constraints of everyday life.<sup>13</sup> Since we have studied behaviors and actions from the inside, often taken part in different activities etc., our analysis used a qualitative grip.

### 2.2.2 Strategy of research

Depicted in Figure 2.1. is the outline for the strategy of our research. The first phase consisted of understanding the purpose and setting goals and delimitations for the thesis, this resulted in a project plan that was aligned with the expectations of the steering committee. The following phases consists of content analysis, studying the concepts of Haldex Way, a literature study of its fundamental concepts, interviews and observations to deepen our understanding and gather input for improvements and an in-depth analysis of the structure and content of the Tier model. The final phase consisted of a complete redesign of the Haldex Way Tier model, including verification of the result, and resulted in an improved Tier model.

The double-headed arrows show the interrelation between the phases and indicate that they are all connected, e.g. interesting topics of improvement found in the literature were discussed during interviews and interesting topics for improvement found during the interview phase were studied further in the literature and so on.



**Figure 2.1. Strategy of research.**

<sup>11</sup> Frankel *et al.*, 'The white space of logistics research', *Journal of Business Logistics*, 2005.

<sup>12</sup> Ibid.

<sup>13</sup> D. Näslund, 'Logistics needs qualitative research – especially action research', *International Journal of Physical Distribution & Logistics Management*, 2002.

### 2.2.2.1 Method of analysis

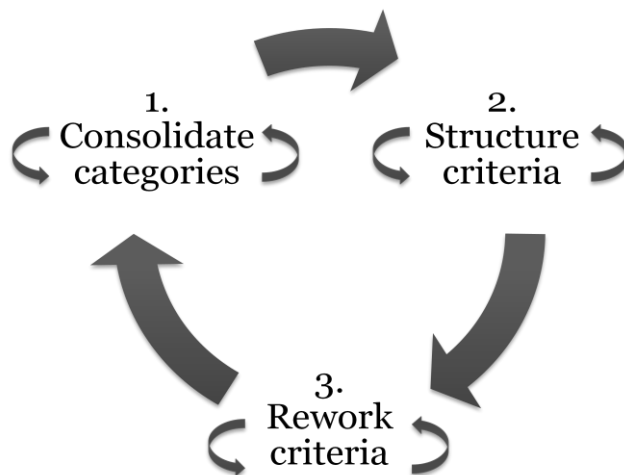
The analysis of the Tier model consists of two major parts, what was referred to as a horizontal analysis and a vertical analysis. During the horizontal analysis, the core themes of the categories are analyzed together with their progression over the levels in the Tier model. Here the introduction of tools and concepts are also analyzed together with the functionality of the Tier model for different parts of the business. In the horizontal analysis, focus lied on analyzing the Tier model category-by-category rather than level-by-level to ensure optimal progression throughout the levels in each category.

In the vertical analysis, focus was within each individual category and concerned the structure of the criteria, formulations, referral to standards, prescriptive/non-prescriptive split and identifying lagging areas in method/implementation/result.

Together the horizontal and vertical analysis resulted in a set of improvement goals to obtain and a matrix showing what is considered to be required for each level, see Sections 5.9. and 5.10.

### 2.2.2.2 Method of redesign

When redesigning categories in the improved Tier model, a three-step methodology illustrated in Figure 2.2. was used. First, chosen categories and criteria in the current model were consolidated into the new, more generic categories (see Section 6.2.1.). Secondly, criteria were fitted into a vertical structure, see Section 6.3. Finally, a redesign process of aligning the criteria was conducted to be able to meet the set of goals found in Section 5.10. and the matrix shown in Figure 5.5.



**Figure 2.2. Structure used when building new categories.**

The loop structure evident in Figure 2.2., illustrates that gradual improvements were made in each step and that many turns were taken before reaching the final result.

### 2.2.3 Data collection

Obtaining good reliable data is crucial for a successful analysis. Today there are many different ways to obtain data, e.g. Frankel *et al.* mentions eight common methods of collecting data; surveys, interviews, observation, focus groups, case studies, experiments,

literature reviews, and content analysis.<sup>14</sup> Worth mentioning is that no single method of collecting data has a complete advantage over another and not all methods suites every research question. What is of importance is that the different methods can be complementary to each other and should preferably be used in combination.<sup>15</sup>

During this study most of the data collection has been achieved through content analysis, literature reviews, interviews and observations. These methods will now be discussed further.

### **2.2.3.1 Content analysis**

Content analysis can be defined as a form of observation, however the great popularity of its application as a stand-alone data collection justifies it being mentioned as a separate method. The content analysis of documents, websites, archival records, etc. provide a somewhat stable and repeated review process which is often discreet, and can provide a broad coverage of data over an extended time span.<sup>16</sup> To learn more about the Haldex Way an extensive review of Haldex' internal training material was conducted in two steps.

The first step of the content analysis was conducted, together with interviews, to build a solid foundation and understanding of Haldex Way and its principles, tools and values.

The second step concerned the in-depth knowledge required about the actual Tier model, the focus for our review. This was done by a detailed study of the structure of the model and by studying the formulation of each criterion.

The review was facilitated by the comprehensive collection of presentations, standards, documentation and even an interactive game available on the Haldex intranet "REACH", complemented by local training material found on local servers.

### **2.2.3.2 Literature reviews**

Literature reviews involve an in-depth analysis and critical summary of other authors' previously collected data, i.e. secondary data. The main purpose for the literature review was to build a solid understanding of the values and principles of the founding concepts of the Haldex Way and to identify a research gap where future studies needed to be addressed. In exploratory and conceptual studies a review of relevant literature provides researchers with a meaningful map depicting the existing connections between the different areas of literature and the research gaps indentified.<sup>17</sup> A thorough study of the concepts, tools, principles and different views of Lean production has been conducted giving perspective and understanding of the core values of Lean production. A study of Business Excellence models has been conducted to be able to build support for a Business Excellence model being added and to enable alignment of the first four levels towards this fifth level. Finally, a review of the literature in the field of change management and organizational learning was done to comprehend the difficulties in moving an organization towards world class performance.

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<sup>14</sup> Frankel *et al.*, 'The white space of logistics research', 2005.

<sup>15</sup> Ibid.

<sup>16</sup> Ibid.

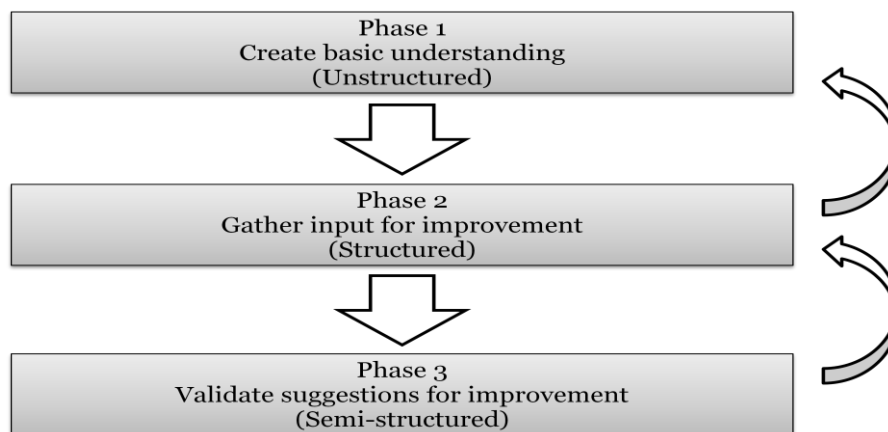
<sup>17</sup> Ibid.

### 2.2.3.3 Interviews

Interviews can cover a wide variety of formats but most often they are designed as a personal meeting between an interviewer and respondent. The types of interviews range from unstructured, semi-structured, to completely structured in format. A completely structured interview is a form of verbal survey with fixed response options whereas the unstructured depth interview is a personal interview in which a single respondent is questioned by a skilled interviewer to uncover underlying motivations, beliefs, attitudes, and feelings on a topic.<sup>18</sup>

We had two overall purposes with conducting our interviews, one being the collection of data, the other to create buy-in for change, allowing the people who will work with the model every day to ventilate their thoughts and ideas. A three-phase structure was used for our interviews, it is depicted in Figure 2.3. The interviewees and their respective position in the Haldex organization can be found in the references.

A first series of interviews were conducted to, together with the content analysis, create a basic understanding of the Haldex Way and its Tier model. Entering the second phase, a clear structure was set for the interviews in order to be able to compare interviewee's answers and input of improvement ideas. For the final, third phase of interviews the main purpose was to validate our ideas for improvements and changes in the Tier model. In Figure 2.3. the upwards pointing arrows indicate an interrelation between the phases as new issues was brought to the surface constantly and created a upwards flow in the structure.



**Figure 2.3. Interview structure used.**

A number of documented interviews have been conducted, with over 30 individuals, throughout the thesis and by taking part in the daily operations many informal interviews have also acted as a good source of information. Effort has been made to cover all relevant aspects of the business by interviewing a variety of positions at Haldex, e.g. site coordinators, change agents, site managers, quality managers, sourcing managers, business model assessors, HR managers, and more. Major parts of Haldex' geographical locations, site sizes and maturity levels in the Haldex Way have also been covered by interviewing employees in Europe, North and South America. Regarding interviewees' positions we have chosen to refer to their role as interviewees rather than their specific title due to reasons of lucidity and integrity, see references. When using interviewees as direct references in the text, we have in this way been able to refer to a more generic title and thus keep interviewees' integrity.

<sup>18</sup> Frankel *et al.*, 'The white space of logistics research', 2005.

#### **2.2.3.4 Observations**

“Observations involve recording the behavioral patterns of people, objects, and events in a systematic manner to obtain information about the phenomenon of interest”.<sup>19</sup>

Our observations were conducted in three major blocks:

In the first block we participated in a challenge for the Silver level at the Automatic Brake Adjuster (ABA) site in Landskrona, here the main purpose of our observations was to create understanding of the use and deployment of Haldex Way.

The second block consisted of a site visit to the Hydraulic site in Birmingham. The main purpose was to see the deployment of the Business Excellence model as the site in Birmingham was quite recently acquired and is using the EFQM model together with Haldex Way.

In the third and final block we participated in a pre-challenge for the Silver level at the Hydraulics site in Skånes Fagerhult, and here the main objective were to observe how our redesigned Tier model would perform in a live setting.

Apart from the three major blocks sporadic observations at the different sites in Landskrona were conducted to observe how specific tools or methods, e.g. 5S, LDMS, etc. are implemented in the production environment.

### **2.3 Trustworthiness and Authenticity**

When conducting scientific research it is important to ensure credibility and trustworthiness of the result. For a qualitative approach, such as the one used for this thesis, this is done by evaluating two main criteria, trustworthiness and authenticity. Authenticity will be handled separately, trustworthiness will be divided into four criteria; credibility, transferability, dependability, and confirmability, this will be explained later on.<sup>20</sup> Different process patterns are also used when analyzing collected data and three prominent approaches are induction, deduction, and abduction.

#### **2.3.1 Induction, deduction and abduction**

When analyzing data, two main approaches are commonly used, the inductive approach and the deductive approach. An inductive approach implies that the gathered data is analyzed in order to create a theory. This approach is often criticized due to the fact that the created theory will not contain anything that is not already in the empirical data. The approach is however good when exploring new fields of expertise. With a deductive approach, it is the other way around, theory should instead be verified through empirical research.<sup>21</sup> The researcher should, on the basis of what is known about a particular issue, deduce a hypothesis that must be subjected to empirical scrutiny.<sup>22</sup>

A third kind of logical reasoning could also be considered, known as abduction. Here induction and deduction are combined to give a logical reasoning where existing theories are

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<sup>19</sup> Frankel *et al.*, 'The white space of logistics research', 2005.

<sup>20</sup> A. Bryman, E. Bell, *Business research methods*, 2007.

<sup>21</sup> G. Wallén, *Vetenskapsteori och forskningsmetodik*, 1993.

<sup>22</sup> A. Bryman, E. Bell, *Business research methods*, 2007.

used for the analysis at the same time as the researcher can use the empirical data to find new relationships.<sup>23</sup>

For this thesis, an inductive research approach has been used as the conducted analysis mainly used a qualitative grip. However some influences from the deductive approach have also been used, especially during the construction of the frame of reference where available information and previous studies on the subject where used.

### **2.3.2 Authenticity**

Authenticity concerns a wider political impact of the research and refers to whether the research fairly represents different viewpoints observed, whether it help members to get a better understanding of their social environment or helps them appreciate the perspectives of other members. It also refers to if the research has acted as an incentive to members to engage in action and if it has empowered members to take the necessary steps to change their circumstances.<sup>24</sup>

In order to ensure authenticity of our work we have interviewed several individuals regarding similar issues and we have cited different sources for the same area of information. To make our research act as an incentive for change we have also had monthly steering committee sessions where everyone are allowed to make their voices heard, and in combination with interviewing a large number of employees at different sites this has been a way to create buy-in for our final suggestions.

### **2.3.3 Credibility**

Credibility concerns whether there is a good match between the researchers' observations and the theoretical ideas they develop, "whether a conclusion that incorporates a casual relationship between two or more variables holds water".<sup>25</sup> This is especially evident in qualitative research where a social behavior can emerge for many different reasons.

To ensure credibility multiple sources have been used for obtaining similar information, a technique often referred to as triangulation. This has been utilized for all our collected data, e.g. written sources, interviews, and observations. A benchmarking study has also been conducted, where the Haldex Way Tier model has been compared with the assessment model of the Volvo Production System (VPS), see Section 5.11.

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<sup>23</sup> G. Wallén, *Vetenskapsteori och forskningsmetodik*, 1993.

<sup>24</sup> A. Bryman, E. Bell, *Business research methods*, 2007.

<sup>25</sup> Ibid.

### **2.3.4 Transferability**

Transferability refers to the degree to which results can be generalized. Qualitative findings usually tends to be oriented to the contextual aspects of the case or social event studied and it is hence important to provide a detailed description of the underlying concepts etc. to provide the reader with enough information for making judgments about transferability to other cases.<sup>26</sup>

In order to ensure transferability of our findings a thorough description of Haldex, Haldex Way, and its principles, core values, etc. is provided in the Frame of reference and Empirical sections. In this way, the reader gets a thorough description of the context of the analyzed Tier model and is hence encouraged to make judgments about the possible transferability of the findings to other cases.

### **2.3.5 Dependability**

Dependability is concerned with the question of whether the results of a study are repeatable, or in other words how stable measurement of a concept is.<sup>27</sup>

In order to provide a repeatable result we have documented our research and analysis methods well and records of the different phases of the research process such as, problem formulation, fieldwork notes, interview transcripts, etc. are kept.

### **2.3.6 Confirmability**

“Confirmability is concerned with ensuring that, while recognizing that complete objectivity is impossible in business research, the researcher can be shown to have acted in good faith...” It should consequently be apparent that the researcher has not allowed personal values or influences from the researched object to alter the conduct of the research and the findings derived from it.<sup>28</sup>

In order to ensure objectivity we have not interfered with any of the collected data prior to our analysis. We have also focused on always obtaining first-hand information from our interviewees and to the largest extent possible also from our written sources of information.

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<sup>26</sup> A. Bryman, E. Bell, *Business research methods*, 2007.

<sup>27</sup> Ibid.

<sup>28</sup> Ibid.

### 3 Frame of reference

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*In this chapter the frame of reference for the thesis is provided, covering the underlying key concepts and ideas of the thesis. The chapter is based on literature studies and content analysis of Haldex 'web-based archives. Throughout the chapter the concepts of Lean production, Business Excellence, Change management and Organizational learning are covered. Finally, a presentation of Haldex Way is given.*

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#### 3.1 Business Excellence models

In 1951, Dr. Joseph M. Juran suggested with his Cost of Poor Quality that a company should strive for an optimum level of quality, beyond which improvements did not make strategic nor financial sense.<sup>29</sup>

It would then be until 1982 before Juran's arguments were countered when Dr. Edwards Deming in his book *Out of the Crisis* stressed the importance of continuous improvement to reduce costs and reach higher levels of both quality and customer satisfaction.<sup>30</sup>

Later, Genichi Taguchi would support Deming by introducing his Quality Loss Function where he argued that any deviation from target would result in a loss to society.<sup>31</sup> Together, Deming and Taguchi created powerful arguments for continuous improvement, arguments that today have evolved into potent concepts and frameworks for continuous process improvement, such as the Business Excellence models.<sup>32</sup>

During the last 20 years, a period of greatly increased competition, both national and international, increasing customer demands and a quickened pace of technological change have put many organizations in a continually moving and turbulent environment. As a result, Business Excellence models have become widely used with the objective of improving organizational performance to meet these forces.<sup>33,34</sup> But what is Business Excellence then? Steve Russell puts it in an original and concise way:

*"In explaining the Excellence model and its benefits to many chief executives, I frequently find myself working backwards, starting with business results and asking the questions: what results are you seeking and what do you need to do to achieve these? They will invariably proceed to describe, in their own words, all of the areas addressed by the Excellence model. It is, after all, meant to be a model for a successful organization."<sup>35</sup>*

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<sup>29</sup> J.M. Juran, *Juran's Quality Control Handbook*, 1988.

<sup>30</sup> W.E. Deming, *Out of the Crisis*, 2000.

<sup>31</sup> G. Taguchi & D. Clausing, 'Robust Quality', 1990.

<sup>32</sup> L.C. Angell & L.M. Corbett, 'The quest for business excellence: evidence from New Zealand's award winners' 2009.

<sup>33</sup> L.J. Porter & S.J. Tanner, *Assessing Business Excellence*.

<sup>34</sup> R. Williams et al., 'Self-assessment against business excellence models: a critique and perspective', 2006.

<sup>35</sup> S. Russell, 'Business Excellence: from outside in or inside out?', 1999.

Most Business Excellence models have their roots in the Total Quality Management (TQM) philosophy but they also have strong influences from techniques such as business process re-engineering (BPR) and the Balanced Scorecard (BSC).<sup>36</sup> Business Excellence models generally take a holistic view and provide for a complete integration and improvement of the organization.<sup>37</sup> The Business Excellence models share the same core themes, this means that in a multinational corporation, the model with the best local support can be used and still achieve the common goal.<sup>38</sup> We have chosen to describe the two largest and most commonly used models in more detail as this will cover the main body of the Business Excellence models and build a strong enough foundation for our analysis.

### **3.1.1 EFQM Excellence Model**

An excellence model that is frequently used among companies in Europe as well as in other continents is the European Foundation for Quality Management (EFQM) excellence model.<sup>39</sup> According to the EFQM the model was intended to “focus attention on business excellence, provide a stimulus to companies and individuals to develop business improvement initiatives and demonstrate results achievable in all aspects of organizational activity”.<sup>40</sup> The model can be used by any business/organization or part of a business/organization regardless of size, sector, structure or maturity and it can be seen as a non-prescriptive framework that recognizes the many different approaches for achieving sustainable organizational excellence.<sup>41,42</sup> For a deeper understanding of the model it is important to understand the three integrated components which the model is based upon, the first being the eight underlying principles which are the fundamental concepts of excellence, see list below adopted from EFQM Model 2010 booklet;<sup>43</sup>

#### **Achieving balanced results**

Excellent organizations meet their mission and progress towards their vision through planning and achieving a balanced set of results that meet both the short and long term needs of their stakeholders and, where relevant, exceed them.

#### **Adding value for customers**

Excellent organizations know that customers are their primary reason for being and strive to innovate and create value for them by understanding and anticipating their needs and expectations.

#### **Leading with vision inspiration and integrity**

Excellent organizations have leaders who shape the future and make it happen, acting as role models for its values and ethics.

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<sup>36</sup> L.J. Porter & S.J. Tanner, *Assessing Business Excellence*, 2004.

<sup>37</sup> Bou-Llusar *et al.*, ‘An empirical assessment of the EFQM Excellence Model: Evaluation as a TQM framework relative to the MBNQA Model’, 2009.

<sup>38</sup> A. van der Wiele, A.R.T. Williams, ‘ISO 9000 series registration to business excellence: the migratory path’, 2000.

<sup>39</sup> EFQM, <http://www.efqm.org/en/Home/Jointhecommunity/Ourmembers/tabid/162/Default.aspx>, viewed on 1 June 2010.

<sup>40</sup> Dale, van der Wiele, van Iwaarden, *Managing Quality*, 2007, p. 543.

<sup>41</sup> British Quality Foundation, *EFQM Model 2010*, 2009.

<sup>42</sup> B. Rusjan, ‘Usefulness of the EFQM Excellence Model’, 2005.

<sup>43</sup> British Quality Foundation, *EFQM Model 2010*, 2009.

**Managing by processes**

Excellent organizations are managed through structured and strategically aligned processes using fact-based decision making to create balanced and sustained results.

**Succeeding through people**

Excellent organizations value their people and create a culture of empowerment for the balanced achievement of organizational and personal goals.

**Nurturing creativity and innovation**

Excellent organizations generate increased value and levels of performance through continual and systematic innovation by harnessing the creativity of their stakeholders.

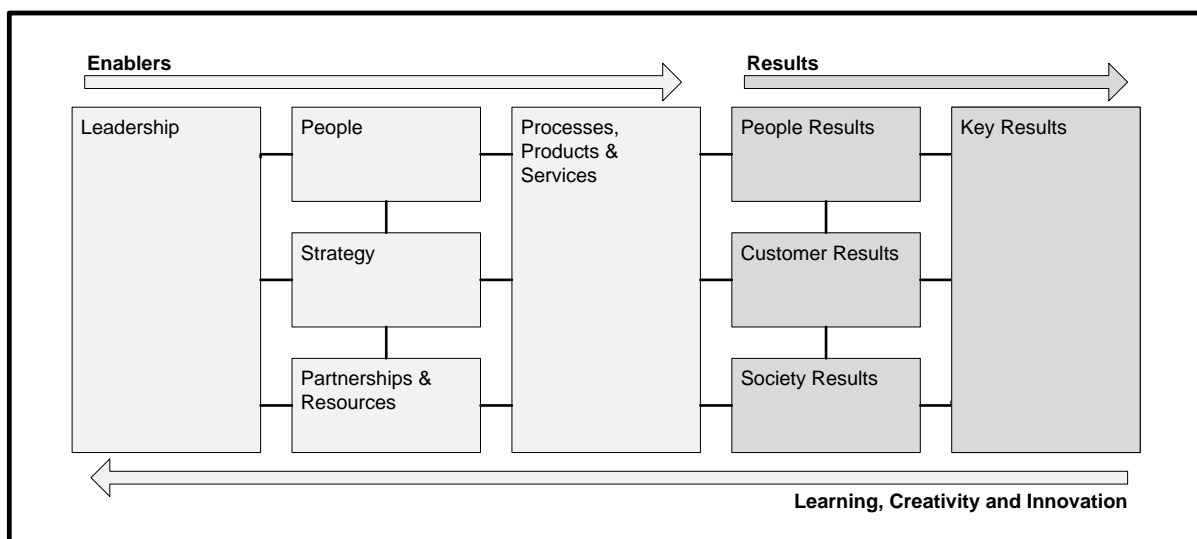
**Building partnerships**

Excellent organizations seek, develop and maintain trusting relationships with various partners to ensure mutual success. These partnerships may be formed with e.g. customers, society, key suppliers, educational bodies or Non-Governmental Organizations (NGOs).

**Taking responsibility for a sustainable future**

Excellent organizations embed within their culture an ethical mindset, clear values and highest standards for organizational behavior, all of which enable them to strive for economic, social and ecological sustainability.

The second component of the three is the EFQM excellence model itself and this model is based on nine criteria; five enablers and four results. Enablers are criteria that explains what an organization does and how it does it and the results criteria cover what the organization actually achieves.<sup>44</sup> In Figure 3.1., the model is visualized and following the arrows one will see the dynamic nature of the model where learning, creativity and innovation will help improve the enablers and hence improve the results.



**Figure 3.1. The EFQM Excellence model.<sup>45</sup>**

<sup>44</sup> British Quality Foundation, *EFQM Model 2010*, 2009.

<sup>45</sup> Ibid.

Each criterion in the model has a clear definition which explains the high level meaning of that explicit criterion, these definitions are also used to assess and measure the performance of an organization.<sup>46</sup> Dale *et al.* have summarized the definitions of the different criteria as follows, these definitions also comply with the ones in the *EFQM model 2010* booklet (2009).<sup>47</sup>

**Leadership**

How leaders develop and facilitate the achievement of the mission and vision, develop values required for long-term success, and implement these via appropriate actions and behaviors, and how they are personally involved in ensuring that the organization's management system is developed and implemented.

**Policy and strategy**

How the organization implements its mission and vision via a clear stakeholder-focused strategy, supported by relevant policies, plans, objectives, targets and processes.

**People management**

How the organization manages, develops and releases the knowledge and full potential of its people at an individual, team-based and organization-wide level, and plans these activities in order to support its policy and strategy and the effective operation of its processes.

**Partnerships and resources**

How the organization plans and manages its external partnerships and internal resources in order to support its policy and strategy and the effective operation of its processes.

**Processes**

How the organization designs, manages and improves its processes in order to support its policy and strategy and fully satisfy and generate increasing value for its customers and other stakeholders.

**Customer results**

What the organization is achieving in relation to its external customers.

**People results**

What the organization is achieving in relation to its people.

**Society results**

What the organization is achieving in relation to local, national and international society as appropriate.

**Key performance results**

What the organization is achieving in relation to its planned performance.

Each criterion also has a number of sub-criteria which will be used in order to assess the organization according to the EFQM standard.<sup>48</sup>

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<sup>46</sup> Dale, van der Wiele, van Iwaarden, *Managing Quality*, 2007, p. 543-544.

<sup>47</sup> Ibid.

<sup>48</sup> British Quality Foundation, *EFQM Model 2010*, 2009.

The final component of the EFQM excellence model is the RADAR logic, a dynamic assessment framework and a useful management tool that provides a structured approach when assessing the performance of an organization, see Figure 3.2.<sup>49</sup> The framework has much in common with the well known PDCA- or Deming cycle. As with the PDCA-cycle, planning allows adaption to the environment and where first determining the result one is aiming at is part of the organization's strategy.<sup>50</sup> Once results have been determined, planning of the approaches to deliver the required results is next. Then the approaches must be deployed in a systematic way to ensure implementation. Finally the deployed approaches must be assessed and refined in order to create a learning organization.<sup>51</sup>

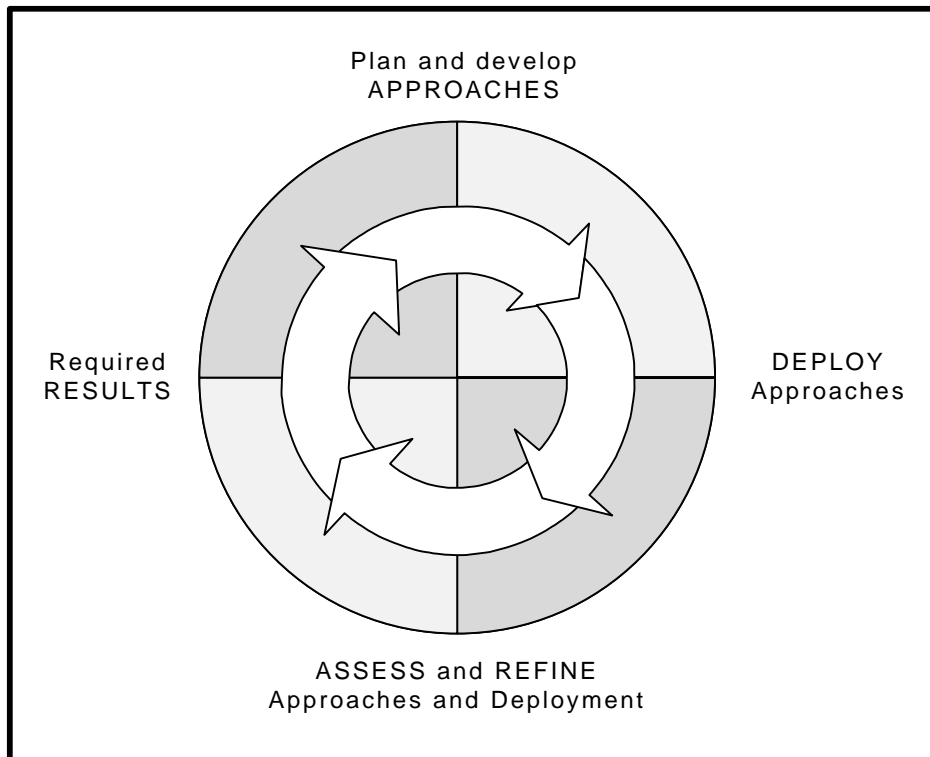


Figure 3.2. The RADAR logic.<sup>52</sup>

### 3.1.1.1 The EFQM organization

EFQM is the custodian of the EFQM Excellence Model and is a not-for-profit membership foundation with the purpose of bringing together organizations that strive for sustainable excellence.<sup>53</sup> EFQM today holds about 600 members that share best practices and exchange knowledge for mutual benefits.<sup>54</sup> EFQM helps organizations to get the most out of their model by training, sharing of best practices, recognizing and engaging people and, of course, by assessments. Assessing the EFQM model can be done both as self-assessments or external assessments, depending on level of maturity and scope.

<sup>49</sup> British Quality Foundation, *EFQM Model 2010*, 2009.

<sup>50</sup> J. I. Martín-Castilla, Ó. Rodríguez-Ruis, 'EFQM model: knowledge governance and competitive advantage', 2008.

<sup>51</sup> British Quality Foundation, *EFQM Model 2010*, 2009.

<sup>52</sup> Ibid.

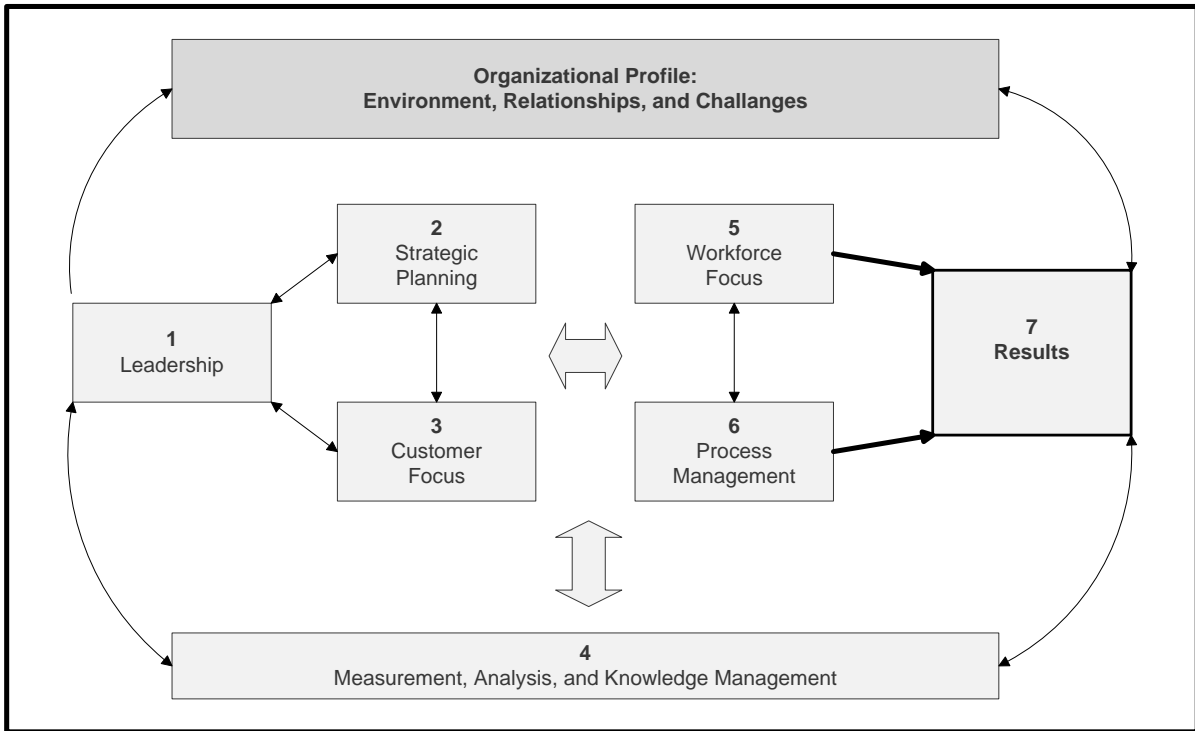
<sup>53</sup> Ibid.

<sup>54</sup> EFQM, <http://www.efqm.org/en/tabid/108/default.aspx>, viewed on 13 July 2010.

**3.1.2 MBNQA Excellence Model**

Another frequently used excellence model, especially in North America, is the Malcolm Baldrige National Quality Award (MBNQA) excellence model. This annual award, and later excellence model, named after a former Secretary of Commerce in the Regan administration, was established in 1987 when President Regan signed the Malcolm Baldrige National Quality Improvement Act.<sup>55</sup> Regan commented the importance of the MBNQA by saying that, “America’s economic strength depends on industry’s ability to improve productivity and quality and to remain on the cutting edge of technology”.<sup>56</sup> The main purpose of the award is to promote an understanding of the requirements for performance excellence and continuous improvements and also to promote the sharing of information on successful performance strategies. Between 1988-2001, 48 companies have won the award and the winners may publicize and advertise their award as long as they agree to share information and best practice about their successful quality and improvement strategies with other organizations.<sup>57</sup>

Organizations applying for the award are evaluated in seven categories with much in common with the eight categories in the EFQM excellence model. The categories interrelate according to the excellence framework as visualized in Figure 3.3.<sup>58</sup>



**Figure 3.3. A systems perspective of the Baldrige excellence framework.<sup>59</sup>**

<sup>55</sup> Dale *et al.*, *Managing Quality*, 2007.

<sup>56</sup> Baldrige National Quality Program, *Criteria for Performance Excellence*, 2009.

<sup>57</sup> Dale *et al.*, *Managing Quality*, 2007.

<sup>58</sup> *Ibid.*

<sup>59</sup> *Ibid.*

Below, the seven categories are briefly explained with the help of information adopted from the Baldrige National Quality Program: Criteria for performance excellence.<sup>60</sup>

### **Leadership**

Examines how an organization's senior leaders' personal actions guide and sustain the organization. It also examines the organization's governance system and how the organization fulfills its legal, ethical, and societal responsibilities and supports its key communities.

### **Strategic planning**

Examines how an organization develops strategic objectives and action plans. It also examines how the chosen objectives and action plans are deployed and changed if circumstances require, and how progress is measured.

### **Customer focus**

Examines how an organization engages its customers for long-term marketplace success, and this so called engagement strategy includes how the organization builds customer-focused culture. Further, it examines how the organization listens to the voice of its customers and uses this information to improve and indentify opportunities for innovation.

### **Measurement, analysis and knowledge management**

Examines how an organization selects, gathers, analyzes, manages, and improves its data, information, and knowledge assets and how it manages its information technology. Also examines how the organization reviews and uses these reviews to improve its performance.

### **Workforce focus**

Examines how an organization engages, manages, and develops its workforce to utilize its full potential in alignment with the organization's overall mission, strategy, and action plans. It also examines the organization's ability to assess workforce capability and capacity needs and to build a workforce environment conducive to high performance.

### **Process management**

Examines how an organization designs its work systems and how it designs, manages, and improves its key processes for implementing those work systems to deliver customer value and achieve organizational success and sustainability. Further, it examines the organization's readiness for emergencies.

### **Results**

Examines an organization's performance and improvements in all key areas – product outcomes, customer-focused outcomes, financial and market outcomes, workforce-focused outcomes, process effectiveness outcomes, and leadership outcomes. Also examines performance levels relative those of competitors and other organizations with similar product offerings.

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<sup>60</sup> Baldrige National Quality Program, *Criteria for Performance Excellence*, 2009.

### **3.1.2.1 National Institute of Standards and Technology**

NIST (National Institute of Standards and Technology) is a non-regulatory federal agency within the U.S. Department of Commerce. NIST's mission is to promote innovation and industrial competitiveness by advancing measurement science, standards and technology. NIST carries out its mission in four cooperative programs, one being the MBNQA.<sup>61</sup> NIST is not a membership organization such as EFQM, but solid support for their model can be found through local support organizations. Assessing the MBNQA model can be done both as self-assessments or external assessments, depending on level of maturity and scope.

### **3.1.3 Pitfalls when implementing Business Excellence**

As with all best practice models, many find it difficult to draw full benefit of the Business Excellence models and it has been discussed whether scoring high in the models is directly correlated to having high organizational performance.<sup>62</sup> An issue when implementing Business Excellence models is that many seek awards for their own sake, the award being the true driver, not achieving better quality.<sup>63</sup> Also, terms and vocabulary in the models are somewhat open to interpretation and differ between models. This leads to that the interpretation of excellence depends on the perspectives of individuals, although it can be argued that this is not a problem that is unique to the area of Business Excellence.<sup>64</sup> Further, critique has been proposed concerning that the Business Excellence models are tactical and operational tools, but is often used as strategic drivers with the expectation that by just implementing a Business Excellence model, success will come.<sup>65</sup> A final critique presented in literature is that the Business Excellence models were created in the 80's and can be outdated if used in an off-the-shelf manner in the volatile markets of today.<sup>66</sup> The difficulties experienced in the implementation of the models leading to lower-than-expected results are not always the users' fault, the custodians of the models have been accused of deficient product positioning and, quite often, overselling of the Business Excellence models.<sup>67</sup>

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<sup>61</sup> NIST, [http://www.nist.gov/public\\_affairs/general\\_information.cfm](http://www.nist.gov/public_affairs/general_information.cfm), viewed on 13 July 2010.

<sup>62</sup> S. Wilford, 'The limits of award incentives: The (non-) relationship between awards for quality and organisational performance', 2007.

<sup>63</sup> Ibid.

<sup>64</sup> Klefjös *et al.*, 'Quality management and business excellence, customers and stakeholders: Do we agree on what we are talking about, and does it matter?', 2008.

<sup>65</sup> D. Leonard & R. McAdam, 'The strategic impact and application of the business excellence model: implications for quality training and development', 2002.

<sup>66</sup> R. Williams *et al.*, 'Self-assessment against business excellence models: a critique and perspective', 2006.

<sup>67</sup> T. Conti, 'A road map through the fog of quality and organizational assessments', 2002.

### 3.2 Lean

Defining what Lean production is (or just “Lean” as it is most commonly referred to today), is not easy. Much because the definition of Lean is very elusive and includes many different parts, principles, and tools both for production and administration areas. Many authors have tried to come to a consensus but the relevance of their work can be questioned, this due to the ever changing nature of management concepts such as Lean or TQM (Total Quality Management), etc. As Pettersen mentions in his article ‘Defining Lean Production’; “Any definition of the concept will only be a still image of a moving target, only being valid in a certain point of time”. The need for a consensus definition is however important since this can help bridge communication difficulties, simplify education and research, and help defining overall goals of the concept. As of today consensus can be found only regarding a handful of collective terms (regarding lean) and their specific characteristics which are mentioned in most research publications, see Table 3.1.<sup>68</sup>

**Table 3.1. Grouping the lean characteristics.**<sup>69</sup>

<b>Collective term</b>	<b>Specific characteristics</b>
Just in Time practices	Production leveling (Heijunka) Pull system (Kanban) Takt production Process synchronization
Resource reduction	Small lot production Waste elimination Set-up time reduction Lead time reduction Inventory reduction
Improvement strategies	Improvement circles Continuous improvement (Kaizen) Root cause analysis (5 why)
Defects control	Autonomation (Jidoka) Failure prevention (Poka Yoke) 100%inspection Line stop (Andon)
Standardization	Housekeeping (5S) Standardized work Visual control and management
Scientific management	Policy deployment (Hoshin kanri) Time/Work studies Multi manning Work force reduction Layout adjustments Cellular manufacturing

<sup>68</sup> J. Pettersen, ‘Defining Lean Production: Some conceptual and practical issues’, 2009.

<sup>69</sup> Ibid.

Apart from the consensus regarding the different tools and characteristics there are two main approaches towards the concept of Lean and Lean production. Either you have a practical and project based view where Lean can be seen as a collection of tools (reducing waste, lead-times, etc.), or you have a more philosophical approach believing that Lean is not just a set of tools but rather a management philosophy. Unfortunately, most practitioners have the former approach of seeing Lean production as just a set of tools, seeing the operational dimension rather than the strategic, which can limit the success of the implementation.<sup>70</sup> Toyota however, sees Lean and Lean production as a philosophy imbedded in their culture and they do not even see the tools as fundamental to Lean, they rather see them as countermeasures and “temporary responses to specific problems that will serve until a better approach is found or conditions change”.<sup>71</sup> Due to the lack of a consensus definition, we have looked at three prominent definitions that we believe give a good overview of the Lean philosophy and concept.

### 3.2.1 Lean according to D.T. Jones, J.P. Womack and Daniel Roos<sup>72,73</sup>

According to Jones, Womack and Roos, the biggest difference between mass production and Lean production lies in their ultimate objectives. Mass producers set a number of goals and settles with “good enough”, meaning an acceptable number of defects, an allowable level of inventory etc. In the ideas of Juran and his cost of quality, to do better would simply cost more than what it would benefit.<sup>74</sup> Lean producers instead set their goal on perfection; declining costs, zero defects, zero inventory and an endless variety of products. Even if they are never able to reach these ultimate goals, they will continually improve.

At the end of the ‘MIT Future of the Automobile Programme’ conducted in 1984, Jones *et al.* were convinced that the competitive advantage of the leading Japanese auto firms were due to their superior organization and production system. This led to the initiation of the ‘MIT International Motor Vehicle Programme’ (IMVP) – a five year, fourteen country research programme to find out what made these Japanese auto producers so superior. What they found was Lean production. Lean production, a term coined by John Krafcik, a researcher at the IMVP, is called just “lean” because it uses less of everything – half of both time and effort to design a product, half of the human effort and tooling to make it with half the defects and less than half the inventory. Lean production is a system, embodying activities such as manufacturing, product development, supply chain partnership, distribution and product strategy and it cannot fully operate until all of the activities are in place.

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<sup>70</sup> J. Pettersen, ‘Defining Lean Production: Some conceptual and practical issues’, 2009.

<sup>71</sup> S. Spear, H.K. Bowen, ‘Decoding the DNA of the Toyota Production System’, *Harvard Business Review*, 1999.

<sup>72</sup> J.P. Womack, D.T Jones, D Roos, *The machine that changed the world*, 2007.

<sup>73</sup> D.T. Jones, ‘Beyond the Toyota Production System: The era of Lean production’, 1990.

<sup>74</sup> J.M. Juran, *Juran’s Quality Control Handbook*, 1988.

Summarizing the definition of Lean by Jones *et al.*, a set of key characteristics are presented:

- Lean is customer driven – not driven by the needs of manufacturing
- All activities are organized and focused on a product line, led by a product champion
- All activities are team based and the organization is horizontally oriented
- The whole system involves fewer actors
- A high level of information is exchanged between all actors
- Activities are coordinated and evaluated by the flow of work through the plant rather than by department
- High level of discipline is necessary, which is exposed by Just-In-Time production, Total Quality and performance evaluation
- Responsibility is devolved to the lowest possible level
- The system is based on stable production volumes, but still with a great deal of flexibility
- Relations with employees, suppliers and dealers are considered as fixed costs

### 3.2.2 Lean according to Liker<sup>75</sup>

After studying the Japanese quality movement and especially the Toyota Production System in the late 1980's and early 90's Jeffrey K. Liker wrote the book *The Toyota Way* where he gave an insight in the management principles and business philosophy behind Toyota's worldwide reputation for quality and reliability. In his book Liker describes Toyota's Lean philosophy with the help of a pyramid with four layers, known as the 4P model (Philosophy, Processes, People and Partners, Problems), illustrated in Figure 3.4.<sup>76</sup>

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<sup>75</sup> J.K. Liker, *The Toyota Way*, 2004.

<sup>76</sup> Ibid.

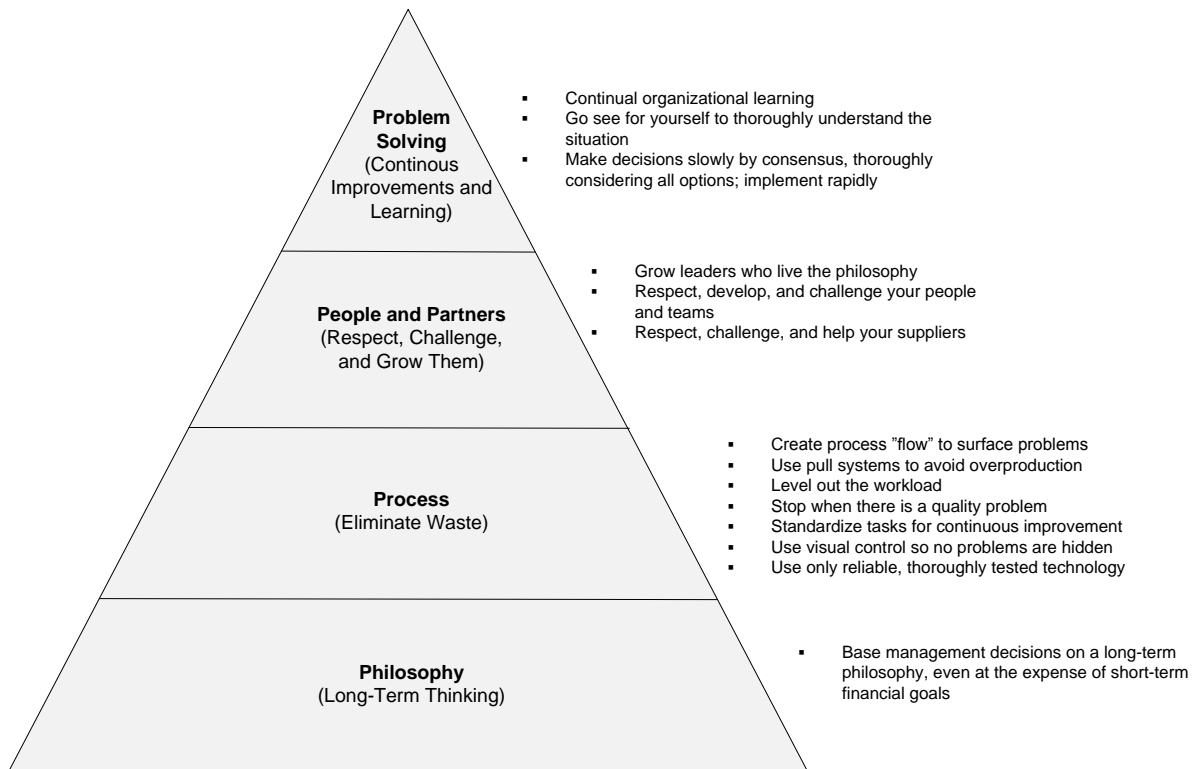


Figure 3.4. The 4P model.<sup>77</sup>

Long-term **Philosophy**: Toyota is serious about long-term thinking, focus from the very top of the company is to add value to customers and society and management decisions are based on long-term philosophy, even at the expense of short-term financial goals.

The right **Process** will produce the right result: As a process-oriented company Toyota has learned that flow is the key to achieving best quality at the lowest cost but with high safety and morale.

Add value to the organization by developing your **People and Partners**: At Toyota the view of management is that they build people, not just cars. Leaders should live the philosophy and it is important to respect, develop, challenge and help the people, teams and suppliers.

Continuously solving root **Problems** drives organizational learning: Identifying root causes of problems and preventing them from occurring is the focus of Toyota’s continuous learning system. Analysis, reflection, and communication of lessons learned are central to improvement as it is the discipline to standardize the best-known practices.

<sup>77</sup> J.K. Liker, *The Toyota Way*, 2004.

### 3.2.3 Lean according to S. Spear et al.<sup>78,79</sup>

Lean production and particularly the original role model, the Toyota Production System (TPS), has been “intensively researched and painstakingly documented”.<sup>80</sup> Many are those who tried to imitate it, some even advised by Toyota consultants, yet most have failed. Researchers, Spear being the most prominent, explains this by concluding that while managers adopt the practices of TPS they fail to apply the four implicit rules that make the system work. These rules govern how people carry out their jobs, how they interact with each other, the flow of products and services, and how people identify and solve process problems. Further, they rigidly specify how every activity, from the shop floor to the executive suite, should be performed. The four rules are as follows:

- All work is highly specified in its content, sequence, timing, and outcome
- Each worker knows who provides what to him, and when
- Every product and service flows along a simple, specified path
- Any improvement to processes, worker/machine connections, or flow path must be made through the scientific method, under a teacher’s guidance, and at the lowest possible organizational level

The key idea is that implementing TPS requires a substantial cultural change, which is often disregarded. Spear *et al.* also give their more general view of TPS, depicted in Figure 3.5. using the four level model conceived by Werr *et al.*<sup>81</sup>

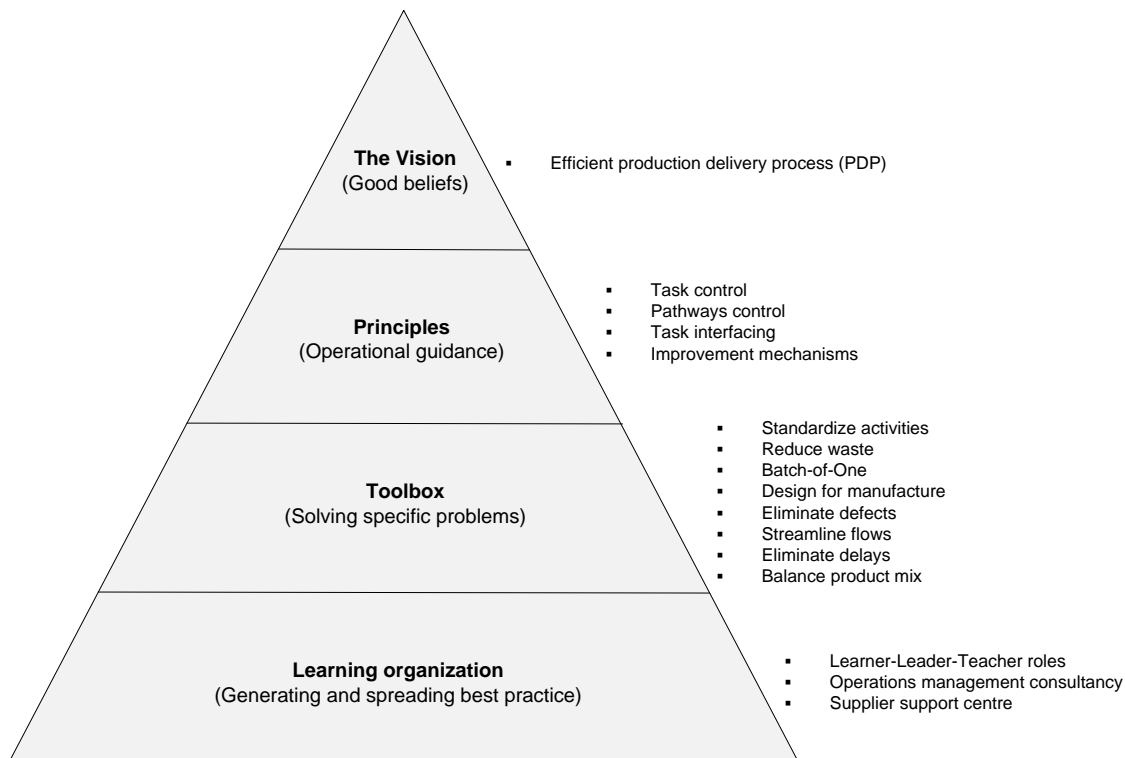


Figure 3.5. A model depicting the four levels of TPS.<sup>82</sup>

<sup>78</sup> S. Spear, H.K. Bowen, ‘Decoding the DNA of the Toyota Production System’, 1999.

<sup>79</sup> D.R. Towill, ‘Exploiting the DNA of the Toyota Production System’, 2007.

<sup>80</sup> Ibid.

<sup>81</sup> A. Werr *et al.*, ‘The functions of methods of change in management consultancy’, 1997.

### 3.2.4 7 types of waste<sup>83,84</sup>

The most fundamental, and reoccurring theme of lean production lies in the elimination of waste. Fujio Cho of Toyota defines waste as “anything other than the minimum of equipment, materials, parts, space, and worker’s time, which is absolutely essential to add value to the product”. But what is value then? Liker defines it simply as the answer to the question “What does the customer want from this process?” Popularly, 7 categories of waste are presented, see Table 3.2. Occasionally an eighth category is introduced concerning the waste of employee creativity, this has been left out. A translation for administration areas has been added as a complement, this to show that although the concepts of Lean come from a production oriented background, they work for administration areas as well.

**Table 3.2. 7 categories of waste.**<sup>85,86</sup>

Type of waste	Description <i>Production</i>	<i>Admin area</i>
Overproducing	Producing too much generate overstaffing, excess storage and transportation.	Producing work or providing a service prior to it being required.
Waiting	Workers waiting for machines or have no work etc.	Waiting for people, signatures or information.
Unnecessary transport	Carrying work in progress (WIP) long distances, double handling, etc.	The movement of work does not add value.
Overprocessing or Incorrect processing	Unneeded steps to process a part, inefficient production due to poor tool and/or product design etc.	Putting more work or effort into work than required by the customer is waste.
Excess inventory	Excess inventory, WIP, finished goods inventory (FGI) cause longer lead times, higher storage costs, risk of items perishing. Also, excess Inventory hides problems.	Stock, work piles and excess supplies are waste. Time is also considered inventory.
Unnecessary movement	Looking for tools, walking, etc. All wasted motion that employees are bound to when performing their work.	Any movement of people, paper or electronic exchanges that does not add value is waste.
Defects	Production of defective parts or correction, repair and rework.	This refers to all processing required to correct a defect.

<sup>82</sup> D.R. Towill, ‘Exploiting the DNA of the Toyota Production System’, 2007.

<sup>83</sup> K. Suzaki, *The new manufacturing challenge: Techniques for Continuous Improvement*, 1987.

<sup>84</sup> J.K. Liker, *The Toyota Way*, 2004.

<sup>85</sup> J.K. Liker & D. Meier, *The Toyota Way Fieldbook*, pp.35-36.

<sup>86</sup> R. Camp *et al.*, *The Lean Office Pocket Guide*, pp. 157-163.

### 3.3 Change Management and organizational learning

Today we live in a world that is constantly subjected to change, this makes today's challenges different from those of the 1960's when the word was "do not fix what is not broken".<sup>87</sup> In today's global economy, which creates bigger opportunities as well as bigger risks for us all, speed of business is as fast as ever and hence managing change cannot be left to chance. However, a brutal fact is that about 70% of all change initiatives fail, mainly because managers in their rush to change their organizations end up in an alphabet soup of initiatives and thus lose their focus.<sup>88</sup> Another reason for failure is that the concept of resistance to change has evolved into a way of blaming others for unsatisfactory results of change, hence, managers responsible for change initiatives blame their employees while the employees blame the managers and nobody accept their role in the failure and take action to prevent it.<sup>89</sup>

#### 3.3.1 Views on change management

According to Beer and Nohria there are two archetypes (or theories) of change, these are Theory E and Theory O.<sup>90</sup> These theories are based on the different assumptions that senior executives, consultants and academics have about why and how changes should be made. Theory E is based on economic value and in this "hard" approach to change shareholder value is seen as the only legitimate measure of corporate success. Theory O on the other hand is based on organizational capability and with this "soft" approach to change, the goal is to develop corporate culture and human capability through individual and organizational learning.<sup>91</sup> In Table 3-3., these two theories are compared along several key dimensions of corporate change.

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<sup>87</sup> J.P. Kotter, *Leading Change*, 1998.

<sup>88</sup> M. Beer & N. Nohria, 'Cracking the code of change', 2000.

<sup>89</sup> S.D Piderit, 'Rethinking resistance and recognizing ambivalence: A multidimensional view of attitudes toward an organizational change', 2000.

<sup>90</sup> M. Beer & N. Nohria, 'Cracking the code of change', 2000.

<sup>91</sup> Ibid.

**Table 3.3. Comparing theories of change.<sup>92</sup>**

<b>Dimensions of change</b>	<b>Theory E</b>	<b>Theory O</b>	<b>Theories E and O combined</b>
<i>Goals</i>	maximize shareholder value	develop organizational capabilities	explicitly embrace the paradox between economic value and organizational capability
<i>Leadership</i>	manage change from the top down	encourage participation from the bottom up	set direction from the top and engage the people below
<i>Focus</i>	emphasize structure and systems	build up corporate culture: employees' behavior and attitudes	focus simultaneously on the hard (structures and systems) and the soft (corporate culture)
<i>Process</i>	plan and establish programs	experiment and evolve	plan for spontaneity
<i>Reward System</i>	motivate through financial incentives	motivate through commitment - use pay as a fair exchange	use incentives to reinforce change but not to drive it
<i>Use of Consultants</i>	consultants analyze problems and shape solutions	consultants support management in shaping their own solutions	consultants are expert resources who empower employees

Another view is presented by Quy Nguen Huy who propose four ideal types of planned change processes; commanding, engineering, teaching and socializing.<sup>93</sup>

The commanding type refers to when a change facilitator, e.g. a manager, applies directive and coercive actions in order to get exact compliance to set goals. The goals are often related to economic performance weighed by clock time and the leadership of change usually belongs to a small group of top managers, often advised by consultants. The commanding type is likely to be relatively effective at changing formal structures and to create fast improvements.

The engineering type refers to when change facilitators take action to analyze, understand and then redesign work processes to improve its speed and quality. The main change facilitators are now task analysts who are skilled in process analysis and organization design and they guide and develop employees' skills. This intervention style tends to be used when the time pressure is more moderate and is proved to be effective at improving work processes. The change management conducted through the Haldex Way framework can be seen as an engineering type of change process.

The teaching intervention refers to an analytical and guided learning approach where the change facilitators take an active role in reeducating employees. The purpose with this approach is to surface the employees' deep beliefs and thereby be able to change them. The teaching type of intervention is effective at changing beliefs and thereby improving organizational capabilities in the long term.

<sup>92</sup> M. Beer & N. Nohria, 'Cracking the code of change', 2000.

<sup>93</sup> Q.N Huy, 'Time, temporal capability, and planned change', 2001.

The last intervention type, socializing, refers to an approach where change facilitators take action to enhance the quality of social relationships in the organization in relation to conducting organizational tasks. In contrast to the commanding approach, this approach does not require the same strategic foresight from top managers. The socializing approach will effectively change social relationships that can improve a firm's organizational capabilities in the long term.

Huy emphasize the importance of sequencing a combination of the different types with appropriate timing in order to get the most beneficial and lasting results of change. Moreover, a table is presented with the limitations of the different change intervention types, see Table 3.4.

**Table 3.4. Limitations of each intervention approach.<sup>94</sup>**

<b>Intervention type</b>	<b>Potential limitations</b>
<i>Commanding</i>	Could create covert resentment and resistance. Seldom leads to lasting, deep change in beliefs and values.
<i>Teaching</i>	Cognitive change does not always lead to sustained behavioral change. Individualistic cognitive change seldom leads to corporate-wide strategic realization.
<i>Engineering</i>	Reinforces autonomy of business units at the expense of corporate-wide integration and cooperation. Successful pilot site experiments rarely spread, for their very success generates defensiveness and rejection by other business units claiming that they are different.
<i>Socializing</i>	Too much socializing could create a splintered, anarchic organization. Groups work at cross-purposes and fight one another for scarce resources. Local expenditure of resources with little clear collective focus. Danger that informal groups indulging in experiential learning may narrow competence and creativity, limit the range of options considered, and tend toward inertia.

<sup>94</sup> Q.N Huy, 'Time, temporal capability, and planned change', 2001.

### **3.3.1.1 Eight steps to transforming your organization**

A prominent framework for managing, or rather leading, change is Kotter's 'Eight steps to transforming your organization', see Figure 3.6. Here Kotter emphasizes that a change process goes through a series of stages and that the process usually requires a considerable amount of time.

The key purpose of the framework is to create support for the change initiative and make everyone feel as a part of the process. This is done by establishing a sense of urgency that helps to motivate people and by creating a future-state vision. The vision is then communicated by all means necessary, both in words and in deeds, and people are empowered and encouraged to act and realize it. To not lose momentum and to keep people motivated it is important to make sure that there are short-term goals to meet and celebrate, hence management must be aware of the difference between creating short-term wins and hoping for them. Finally, the increased credibility that the short-term wins have created should be used to change systems, structures and policies that do not fit the vision and the connections between the new behaviors and corporate success should be articulated in order to institutionalizing the new approaches.<sup>95</sup>

Skipping steps in the eight step process is not recommended, and worth mentioning is that critical mistakes in any of the phases may have devastating impact further on.<sup>96</sup>

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<sup>95</sup> J.P. Kotter, *Leading Change*, 1998.

<sup>96</sup> J.P. Kotter, 'Leading Change: Why transformation efforts fail', 1995.

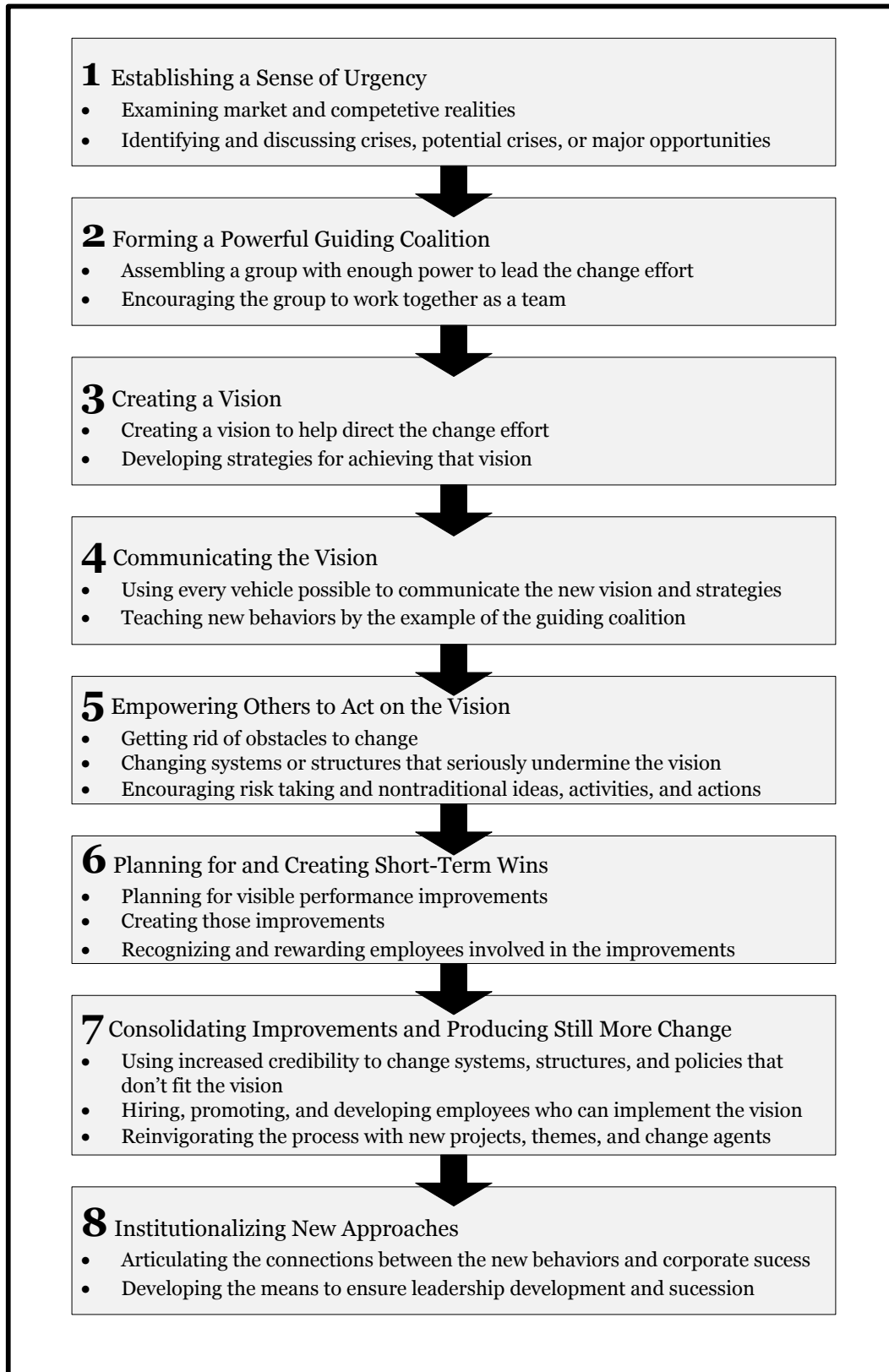


Figure 3.6. Eight steps to transforming your organization.<sup>97</sup>

<sup>97</sup> J.P. Kotter, 'Leading Change: Why transformation efforts fail', 1995.

### 3.3.2 Organizational learning

All organizations learn, it is a fundamental requirement for their sustained existence.<sup>98</sup> But what is organizational learning? - Organizational learning is closely interlinked with individual learning, a concept we all are quite familiar with, and ultimately organizations learn through their individual members. Making it more complex is the fact that organizations can learn independent of any specific individuals, but not independent of all individuals.<sup>99</sup> Hence, organizational learning is not only individual learning yet an organization can learn only through its individuals.

Organizational learning includes the detection and correction of errors. If the correction still allows the organization to carry on with its current policies and principles then the process of detecting and correcting an error is defined, by Argyris and Schön, as “single-loop” learning.<sup>100</sup> Single-loop learning can be compared to a thermostat, receiving information about the temperature and correcting by switching the heat on and off. Organizations often handle this type of actions quite well, but what they have a harder time with is what is referred to as “double-loop” learning. Double-loop learning result from corrective actions that involve the modification of an organization’s underlying principles, policies and values.<sup>101</sup> The difficulties involved in double-loop learning is due to that organizations tend to create learning systems that inhibit this type of learning. The reason is that double-loop learning will uncomfortably question the founding norms and principles of the organization and, ultimately and most unfortunately, hold back the true benefits of learning. Implementing a Business Excellence model will involve deep change, and thereby require double-loop learning.<sup>102</sup>

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<sup>98</sup> D.H. Kim, ‘The link between Individual and Organizational learning’, 1993.

<sup>99</sup> Ibid.

<sup>100</sup> C. Argyris, D.A. Schön, *Organizational learning: A theory of action perspective*, 1978.

<sup>101</sup> Ibid.

<sup>102</sup> A. van der Wiele, A.R.T. Williams, ‘ISO 9000 series registration to business excellence: the migratory path’, 2000.

### 3.4 Haldex Way<sup>103,104</sup>

Haldex Way is the Haldex Group's overall management system and it has its roots in the well-known Lean philosophy. Haldex Way uses a set of well-proven tools and concepts originating from the Toyota Production System. It also incorporates newer concepts and it is continually evolved and improved. The link between these tools and the management system is illustrated by an umbrella analogy, see Figure 3.7. However, Haldex Way is more than what meets the eye, it is a paradigm that provides the structure, language and framework for how to develop and improve the business and the people of the organization, it has a strong focus on customer satisfaction and provides the road towards world-class performance. It identifies the core values of the entire business and is applicable throughout a site's functions. Haldex Way is used in all Haldex sites and currently one site is on the Gold Tier level, three are at Silver, 16 are at Bronze, 14 at Copper and only five minor sites did not pass any challenge yet (May 2010).<sup>105</sup>

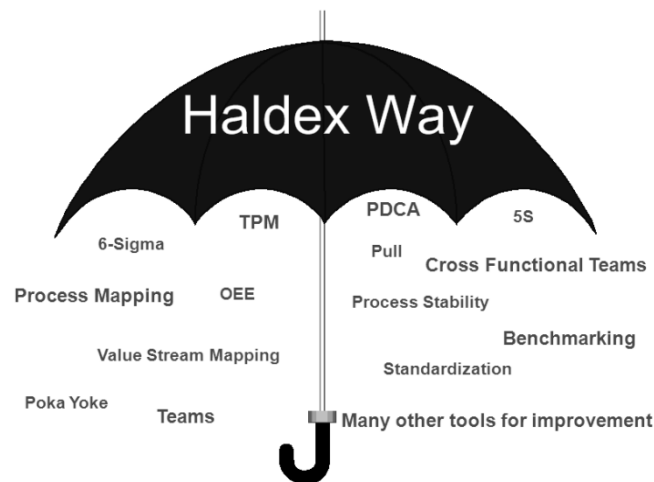


Figure 3.7. Illustration of Haldex Way.<sup>106</sup>

#### 3.4.1 History

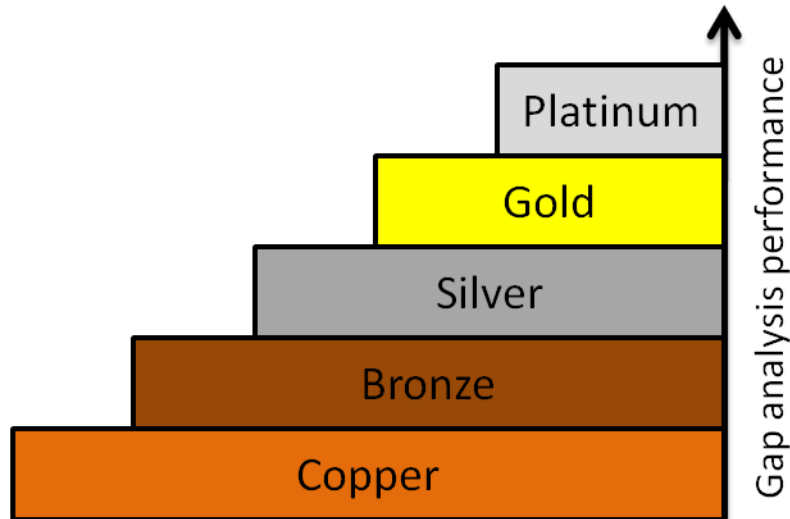
The work with Haldex Way, originally an offspring of Scania's production system, started around the turn of the century. As development was slow in the beginning, and to help the progression of each site, a gap analysis tool was later developed as part of a master's thesis. The Gap analysis tool measures the gap between a site's current performance and world class performance and it is used to assist aligning improvement activities. To close the gaps found and to provide a more accessible road towards the final goal, the Tier model was developed, see Figure 3.8. As seen in Figure 3.9., each step in the model has been added gradually, allowing the model to mature and evolve for each level.

<sup>103</sup>Booklet by Dantoft *et al.*, *The Haldex Way*, 2<sup>nd</sup> ed., 2006.

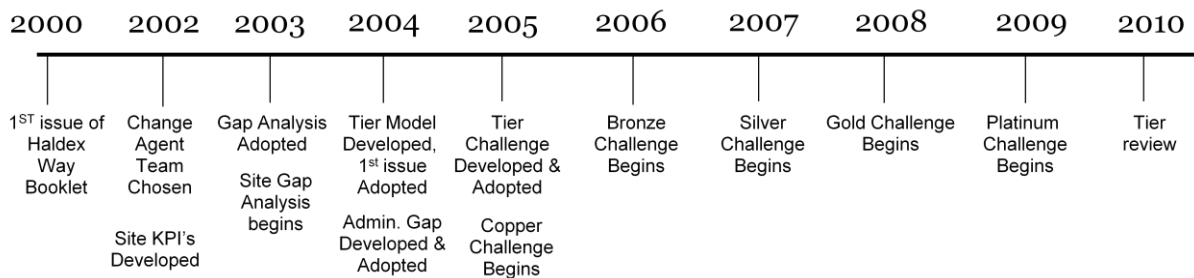
<sup>104</sup> Interview with Haldex Change agent.

<sup>105</sup> REACH, *Haldex Way Tier Status Report*, May-10.

<sup>106</sup> REACH, *Introduction to Haldex Way Management System*, 2005, revised 2009.



**Figure 3.8. Illustration of how the Tier model facilitate closing the gaps found in the Gap analysis.**



**Figure 3.9. Illustration of the development of Haldex Way.<sup>107</sup>**

### 3.4.2 The structure of Haldex Way<sup>108</sup>

Haldex Way is based on the Haldex Group’s three core values; Customer first, Respect for the individual, and Elimination of waste.

#### **Customer first**

Haldex’ employees should base their decisions and actions on the customer’s best interests, well aware that the added value created for the customer also creates added value for Haldex, its employees and its owners.

#### **Respect for the individual**

Haldex’ success depends on individuals taking personal responsibility and working together effectively. This should be promoted by showing one another respect through open communication, by encouraging initiative, cooperation, support, professional growth and advancement, by providing performance-based compensation and by taking active responsibility.

#### **Elimination of waste**

Haldex’ operations promote a responsibility to manage all resources and eliminate waste in the most efficient and profitable way. Only in this way can Haldex create added value for all interest groups; customers, shareholders, employees and society.

<sup>107</sup> REACH, *Introduction to Haldex Way Management System*, 2005, revised 2009.

<sup>108</sup> Booklet by Dantoft *et al.*, *The Haldex Way*, 2<sup>nd</sup> ed., 2006.

### **3.4.2.1 The ten principles**

Along with the three core values all improvement work is based on ten fundamental principles;

#### **Consumption controlled process**

Work should never start before a customer signals a demand – the pull method. A pull signal could be visual buffers (Kanban), reorder points or sequences. Flows should be linked without delays.

#### **Capable process – Right from me**

It should be possible to do things correctly from start by means of suitable tools, work instructions and methods that make it impossible to make an error. Errors should never be passed on and the correct inspection methods should be used.

#### **Continuous improvement**

With repetitive stable standard procedures in place, results should constantly be challenged. Everyone in the team should have full information about performance and deviations from standard and work to improve it.

#### **Standardization**

A best method for each process should be identified, standardized and repeatedly used. Work sequences should be clearly defined and there should be a common approach. This is the basis for continuous improvement.

#### **Balanced flow**

Activities should be evenly distributed between processes in the flow, buffers are when needed used to balance the flow.

#### **Leveled flow**

To optimize use of equipment and to minimize manual labor it is essential to evenly distribute production over available time.

#### **Real time**

Ensuring no delays in the system means that any abnormality can be discovered immediately. Feedback can be instant and the root cause of errors can be corrected quickly.

#### **Takt time**

The Takt time is Haldex' pulse, it is defined as the available time divided by customer demand. All volume and daily output shall be controlled by the Takt time and thereby customer demand.

#### **Go & See**

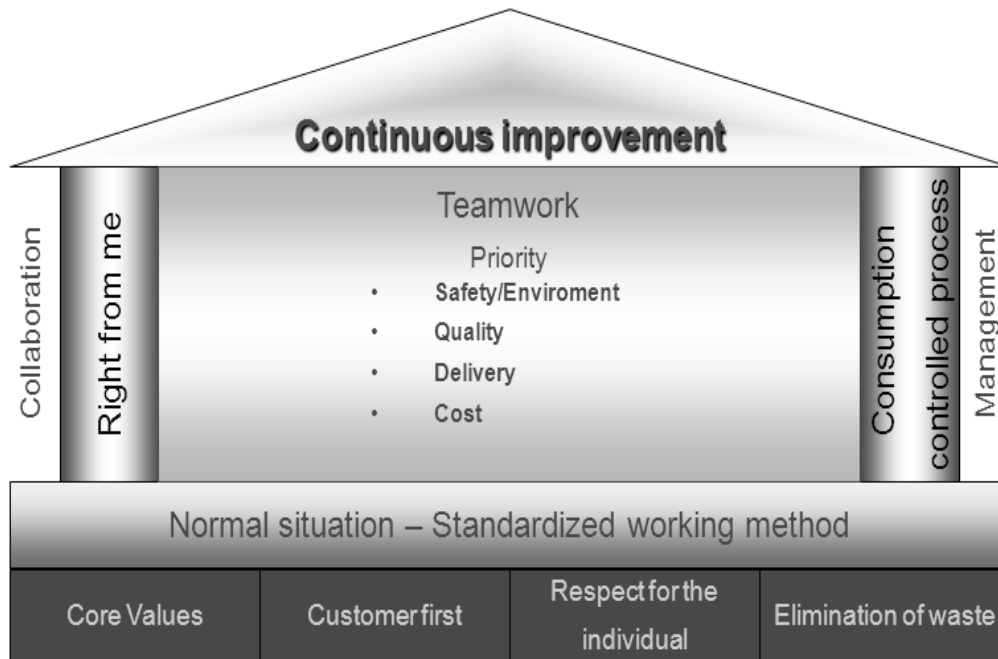
Leadership should be participative and supportive. Leaders should continually be at the workplace in order to understand the work and problems that can occur. Both processes and employees should be developed, leaders should coach and follow up.

#### **Visual**

Everyone should easily be able to see what is normal and what deviates from the standard. It should be easy to follow a process visually, with continuous performance information available.

### 3.4.2.2 The Haldex Way House

Describing Haldex Way from a holistic perspective, the Haldex Way house is often used as an illustration, see Figure 3.10. It illustrates how Haldex should, on the foundation of the core values and principles, build a culture of continuous improvement. Inside the Haldex Way house the importance of teamwork is highlighted together with the order in which all issues should be prioritized.



**Figure 3.10. The Haldex Way House.<sup>109</sup>**

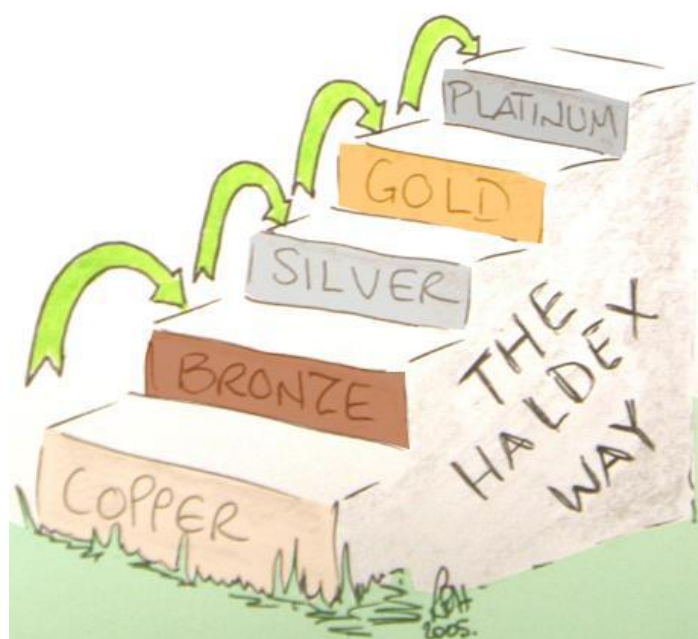
<sup>109</sup> REACH, *Core values and principles in the house of Haldex Way*, 2008.

## 4 Empirical study

*In this chapter a more thorough presentation of the Tier model will be given. This will give the reader enough knowledge to understand the full context of the study and it will also provide necessary information needed for the analysis. Data originates from Haldex' intranet, REACH, site observations and several interviews with Haldex employees.*

### 4.1 The Haldex Way Tier model

The Tier model facilitates the deployment, assessment, and progression of Haldex Way by offering a set of reachable sub steps towards the final goal, illustrated by a staircase, see Figure 4.1. By using the Tier model, implementation is flexible and work and perspectives can differ from site to site. This while ensuring that overall goals are aligned and targets for every level stays the same.



**Figure 4.1. Illustration of the Haldex Way Tier model.<sup>110</sup>**

In essence the Haldex Way Tier model, illustrated by the staircase in Figure 4.1., consist of four challenge documents, “Copper”, “Bronze”, “Silver” and “Gold”. The “Platinum” level is under construction and will be introduced shortly. The challenge documents are used during the audit-like challenges, but also, more importantly as a roadmap and guidance for self-assessment and development by the sites. Each challenge document consists of a Microsoft Office Excel workbook containing a dashboard on the front page and a large amount of criteria, structured in a set of categories.

The dashboard, see Appendix A, provides an overview of the site’s progression in regard to the specific level. It contains KPIs that have to be met by the site for that specific level and also a set of colored bar graphs, one for each category that will be challenged. The bars range from red, meaning unacceptable to green which signals that the performance is satisfactory.

<sup>110</sup> Booklet by Dantoft et al., *The Haldex Way*, 2<sup>nd</sup> ed. 2006.

In between one will find a yellow area meaning improvement is needed. Other required criteria for the challenge, such as ISO certifications etc. can also be found on the dashboard. The dashboards have slightly different appearance depending on what level it is on, mainly due to the gradual development of the different tier levels. Following the dashboard is a set of worksheets, one for each category that is assessed in the challenge. Each category consists of a set of criteria on a specific subject and each criterion in turn refers to a smaller set of evidence that needs to be presented during the challenge. Each evidence holds a score and the sum of the total category's score always add up to 100 points.

#### **4.1.1 Conducting a challenge**

For a site to climb up a step in the Tier model, it has to meet a challenge specific for that level. A challenge is fundamentally an audit although the term “challenge” is used instead of “audit” to give it a more positive and motivating tone. A challenge is normally conducted by two to three trained auditors (site coordinators, change agents or equivalents from other sites) and normally takes around three days, depending on circumstances. The opportunity for a coordinator to act as an auditor gives them deeper knowledge of the Tier model and excellent chances of benchmarking and exchanging best practices and experiences in implementing Haldex Way. In order to pass a challenge, the site needs to meet the set targets for each site KPI, they need to be certified according to requested ISO standards and a specific number of categories need to score into the green area of the bar graphs.

#### 4.1.2 Structure of the current model

All levels in the Tier model each contain a different set of categories where only a rare few range over all levels. The Copper level contains 11 categories, Bronze 14, Silver 19 and Gold 15. In total the model contain 33 categories, see Table 4.1.

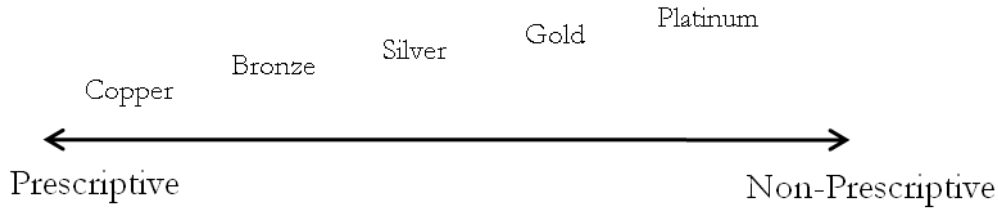
**Table 4.1. Categories by Tier level.**

5S	Copper	Bronze	Silver	Gold
KPI reporting	Copper			
Gap Analysis	Copper			
Education	Copper			
Communication	Copper			
Standardization	Copper	Bronze	Silver	Gold
Cell team	Copper			
Steering committee	Copper			
Principles & Values	Copper	Bronze	Silver	
VSM	Copper			
Preventative maintenance	Copper			
Takt		Bronze	Silver	
Set-up & Change over		Bronze	Silver	Gold
Poka Yoke		Bronze	Silver	Gold
Consumption control - Pull		Bronze	Silver	Gold
TPM - OEE		Bronze		
Go & See		Bronze		
Cross-functional teams		Bronze		
Site KPI		Bronze	Silver	
Process KPI		Bronze	Silver	
Process mapping & VSM		Bronze	Silver	Gold
Visualization		Bronze	Silver	Gold
TPM			Silver	Gold
OEE			Silver	
Continuous imp. Teams			Silver	Gold
Full value streams			Silver	
Balanced flow			Silver	
Product development			Silver	Gold
6 Sigma			Silver	Gold
Quality			Silver	Gold
Takt & Balanced flow				Gold
Process stability				Gold
KPIs				Gold

Inside each category is a set of criteria that cover a wide range of aspects within the given category; educational concerns, planning, implementation, results, visualization, procedures etc. In most categories no clear structure of criteria is evident. Consequently, a criterion regarding standards in a given topic can be followed by a criterion assessing the implementation of a tool, just to go back in the third criterion to the use of standards.

**4.1.3 Prescriptive / non-prescriptive split**

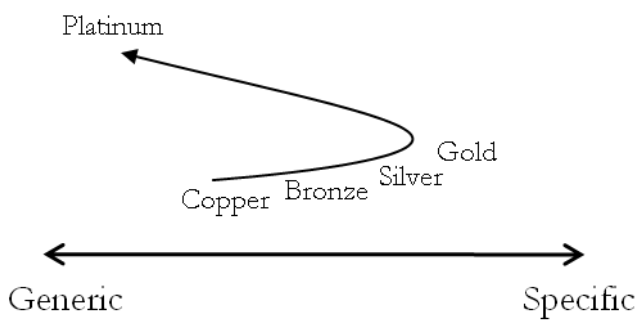
To ease the first stumbling steps on the road towards business excellence, the Tier model takes a quite prescriptive grip in the lower levels. This is done, to a large extent, by defining what tools that should be used, what education should be conducted etc. As a site progress through the Tier levels, the model becomes less prescriptive and the site is allowed larger responsibility in how to implement the appropriate tools to reach the defined goals in the criteria. How prescriptive the Tier model is in each specific level is mainly evident in the formulation of the criteria. Illustrated in Figure 4.2., is the different Tier levels and our perception of their respectively position on the prescriptive / non-prescriptive scale.



**Figure 4.2. Prescriptive/non-prescriptive split of the Tier model.**

**4.1.4 Functionality in different parts of the business**

Looking at the evidence and goals for the criteria, one will find that the Copper level takes a fairly generic grip, improvement goals are relatively broad and the required evidence are explained shortly and straightforward. Moving forward in the Tier model, Bronze, Silver and Gold becomes increasingly specific, meaning that goals are set on more specific targets, evidence are expounded on, and additional features are added. The adding of the process/function categories Product development and Quality in the Silver level has also increased the specificity of the later levels. A general observation is that explanation of criteria gets longer and fuller and clarifications are added when thought needed. Regarding the fifth level, being the Business Excellence model, this takes a fully generic standpoint in its goals and evidence. A crude representation of the generic / specific split in the Tier model is illustrated in Figure 4.3., and has a slightly awkwardly looking, boomerang shape.



**Figure 4.3. Generic/specific split of the Tier model.**

**4.1.5 Standards**

The work with standards has come a long way since the beginning of Haldex Way. Hence, the use of standard definitions and the referral to standard documents become stronger as one progress to the higher levels. A lack of standards in the lower levels combined with the lack of a uniform language result in diverse formulations of criteria throughout the levels.

#### 4.1.6 Principles and Values

A general critique repeatedly presented during our interviews is that the founding principles and core values of Haldex Way are not explicit enough in the Tier model. They tend to get lost among the wide variety of tools and concepts. By looking at the dashboard of each challenge document one could quite easily identify two of the three core values in the site KPIs, being the elimination of waste (Inventory days, Time per Unit and First Time Pass Rate) and the customer first (Delivery, 0 Km returns and Warranty cost). The third core value though, respect for the individual, is conspicuously absent.

#### 4.1.7 Categories in the current Haldex Way Tier model

The categories in the Tier model differ between the Tier levels and include tools, procedures, principles and values, etc. Below, all categories in the existing Tier model will be briefly explained, their presence in the Tier model is also displayed next to respective headline. Information and data to all descriptions originates from Haldex intranet, REACH, and interviews with employees at a variety of positions at Haldex.

#### 5S **Copper** **Bronze** **Silver** **Gold**

5S is a system for indentifying and eliminating the seven kinds of waste, (see Section 3.2.4.), and it is applicable for production as well as administration areas. The concept of 5S is that the best environment is one that is safe, predictable and repeatable, and once this is achieved 5S lays the foundation for other improvements such as TPM or set-up time and change-over reductions. Working with 5S involves following a five step implementation plan where each step represents one of the S's.<sup>111</sup>

- 1 S: *Separate & Scrap*, cleaning up, getting rid of everything not needed.
- 2 S: *Straighten*, organizing useful items, “a place for everything and everything in its place”.
- 3 S: *Scrub & Shine*, initial deep cleaning and regular housekeeping, “cleaning is inspection, inspection is detection, detection is correction”.
- 4S: *Standardize & Spread*, move on to all workplace areas and implement best practices throughout the facility.
- 5S: *Systemize*, personal commitment to high housekeeping standards and making sure that all workers are intolerant of a dirty workplace.

#### KPI reporting **Copper**

This category is meant as an introduction to working with the site KPIs. It exists to ensure that KPIs are; displayed in administration and production areas, that they are reported to Stockholm (global headquarter), and that they are actively used in management reviews.

#### Gap analysis **Copper**

The Gap analysis is a tool used to review how an area/site is performing with respect to Haldex three core values; customer first, elimination of waste, and respect for the individual. The analysis is performed in three sections, one for each core value, and the identified gap between the current status and that of world class operations is used to direct improvement measures.

<sup>111</sup> REACH, *5S Presentation English*, 2006.

**Education** **Copper**

This category ensures that all employees are educated in the Haldex Way core values and principles and that all employees know something about Haldex Way in accordance to their department/work task.

**Communication** **Copper**

Communication introduces a communication standard based on communication boards. What should be posted, where, and at what frequency is handled together with ownership of the different communication boards.

**Standardization** **Copper** **Bronze** **Silver** **Gold**

Standardization is the basis for continuous improvements and involves defining the best-known method for performing an activity and making sure that this activity is performed in the same way every time. At the lower levels employees should be introduced to the concept of standardization and the process capability of the critical manufacturing equipment should be known, (process capability can be seen as the capability of a process to meet its purpose). Further on in the later levels of the Tier model standard work instructions/procedures should exist for production as well as administration tasks. Standard templates should exist for the different tools used, e.g. 5S, Gap analysis, Value stream mapping, etc.

**Cell team** **Copper**

The Cell team category is meant to introduce teamwork and especially that in what is referred to as “cell teams” to the employees. A first pilot area should have been identified and training and development of a first pilot cell team should have begun, the team’s objectives should also be clearly defined and training on a selected problem solving model should have begun (e.g. 8D, PDCA, DMAIC, etc).

**Steering committee** **Copper**

This category makes sure that a Haldex Way steering committee has been formed and that its members are from top management, administration, and operations. The Haldex Way steering committee should develop a multi-year Haldex Way implementation plan and help support and encourage “the Haldex Way language” which improves the culture/behavior that helps a site on its journey on the “Haldex Way road”, see Figure 1.1.

**Principles and values** **Copper** **Bronze** **Silver**

Principles and values exist to strengthen the three core values and the ten principles of Haldex Way. At the lower levels focus lies on communicating/displaying the principles and values whereas at the higher levels it is of greater importance that the employees actually are aware of the values and principles and know how they can affect them. It is also important that improvement activities, KPIs etc. are linked to these principles and values.

**Value stream mapping** **Copper**

Value stream mapping introduces the employees to the concept and educates them to the level where value stream maps are part of the overall site improvement plan. The concept of value stream mapping is about understanding that the complete stream/flow goes from the supplier to the end consumer and that there is a distinction between value added activities, which the customer is likely to pay for, and non value added activities which are only creating costs and no revenue. Focus is on information along the value stream and on optimizing the value stream in regard to lead-times, inventory levels, and other quantitative data.

### **Preventative maintenance** **Copper**

Preventative maintenance makes sure that instructions for employee maintenance is developed and that employees are beginning to do maintenance within their own processes.

### **Takt** **Bronze** **Silver**

This category exists to introduce employees to the concept of Takt time and to start using Takt time as a way to pace output. Takt time reflects sales, and can consequently be seen as Haldex' pulse. The Takt time is defined as the available time divided by customer demand. Volume and daily output should always be controlled by the current Takt time.

### **Set-up & Change over** **Bronze** **Silver** **Gold**

In this category focus is on minimizing set-up and change over times, this is important since a "taktet"/consumption controlled production means small batches and a lot of set-ups, change-overs, die changes, etc. The SMED (Single Minute Exchange of Die) methodology is introduced and work throughout the Tier levels is done according to a framework, where focus is on transforming IED (inside exchange of die, the time when the equipment must stand still for a change) to OED (outside exchange of die, time for preparation that can be done when the equipment is running).

### **Poka Yoke** **Bronze** **Silver** **Gold**

Poka Yoke is a technique for eliminating errors, it is based on the fact that it is good to do things right the first time and even better to make it impossible to do it wrong. Implementing Poka Yoke in products and processes, in other words mistake proofing, is done to eliminate the source of errors and obtain zero defects. Poka Yoke solutions are normally implemented following a few predefined steps;<sup>112</sup>

- Identify problems. Look at customer returns, defective parts analyzes and error reports.
- Seek out the root cause. Investigate until you truly understand the source of the error. Correct the mistakes at their source.
- Create solutions. Make it impossible to do it wrong.
- Measure the results. Has the error been eliminated?

Haldex has widened to concept of Poka Yoke to rather be seen as an error-proofing concept where mistake proofing solutions do not necessarily have to make it impossible to do wrong but rather make it harder to do wrong. Error-proofing solutions may for example also include added inspections. The reason for widening the concept is the often huge investments related to creating Poka Yoke solutions for everything, even though an error-proofing would be sufficient.

### **Consumption control - Pull** **Bronze** **Silver** **Gold**

This category introduces employees to the concept of consumption control and introduces tools and methods to facilitate internal as well as external consumption controlled processes. Consumption controlled production involves manufacturing only what the customer orders and never start producing before a customer signals a demand, i.e. the pull method. Pull

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<sup>112</sup> REACH, *Tool 13 Poka Yoke Guidelines*, 2010.

signals can exist in the form of kanban, visual buffer, reorder points, etc. and the flows are linked to each other without delays.

**TPM - OEE** **Bronze**

The TPM (Total Productive Maintenance) and OEE (Overall Equipment Effectiveness) category introduces employees to the concepts above, where TPM establishes a system in the workplace to take control and prevent various losses on manufacturing equipment in order to achieve targets of zero breakdowns, zero defects, and zero accidents. OEE is a measure of how well the equipment is performing and it goes beyond simple downtime measures and considers what percentage of time the equipment is running at its rated capacity producing good quality parts, see formulae on the next page. At this lower Tier level focus is on the basic understanding of the concepts and to identify quality and capacity critical equipment.

**Go & See** **Bronze**

Go & See ensures that leaders and senior management are seen in the work areas, that they understand the work and problems, and that they are participating in events and Haldex Way activities such as 5S, Value stream mapping, Process mapping, Team meetings, etc. Leadership should be supportive, participative, and coaching.

**Cross-functional teams** **Bronze**

This category makes sure that cross-functional teams have been formed and trained and that regular meetings are held with team activities being communicated to the Haldex Way Steering committee.

**Site KPI** **Bronze** **Silver**

Site KPI targets as well as action plans should all be linked to a multi-year strategic plan. Site KPIs should also be reviewed monthly with the employees. For the Bronze level it is enough for all employees to know the meaning of the existing KPIs and how they (as employees) can affect the results.

**Process KPI** **Bronze** **Silver**

A process KPI does not measure the performance of the entire site but rather a part of the business, such as a specific process. At the Silver level workgroups and cell teams have developed relevant KPIs for their processes. Trends, goals and objectives should also be developed for the process KPIs.

**Process mapping & Value stream mapping** **Bronze** **Silver** **Gold**

This category introduces the concept of Process mapping/Flow charting to the employees and at the different Tier levels various levels of detail and follow-up is required. A process map answers the question; How does the work actually get accomplished? And it shows tasks, sequence of tasks, inputs, and outputs for a particular work process. A good map helps to understand how the process currently works and it promotes understanding in a way that written procedures cannot do. When a process map has been constructed it is important to look for non-value added steps, excessive control points and excessive handoffs that can all be eliminated. Further work with value stream mapping is conducted in accordance with the recommendations in the previous category 'Value stream mapping'.

**Visualization** Bronze Silver Gold

Visualization and visual management enables the current and past performance to be easily seen and understood, it allows comparing customer requirements output to actual output and it enables anyone to identify non-conformance. Visualization normally comes in the form of lights, colors, signs, information boards, work instructions, etc. and at Haldex all alternatives to written text can be considered a form of visualization, such as pictures, process maps, VSMs etc.

**TPM (Total Productive Maintenance)** Silver Gold

In this category the concept of TPM is further developed and the seven step TPM approach is used.<sup>113</sup>

1. Conduct initial cleaning (5S standards).
2. Eliminate sources of contamination and inaccessible areas.
3. Establish provisional cleaning, inspection and lubrication standards.
4. Conduct general training to develop inspection procedures.
5. Conduct general inspections regularly and improve inspection procedures.
6. Improve workplace organization and control.
7. Participate in advance improvement programmes.

The goal with TPM is to facilitate operator ownership and pride in equipment by everyone and thereby improving equipment conditions and overall effectiveness.

**OEE** Silver

At the Silver level work with OEE continues, an OEE trend over the past 6-12 months should be available, improvements implemented and activities accomplished should be clearly identified. OEE consists of three parts; availability, performance and quality and as these are multiplied the final result can never exceed 100%.<sup>114</sup>

$$OEE (\%) = Availability \times Productivity \times Quality$$

$$Availability (\%) = \frac{Total\ available\ time - Unplanned\ downtime - Planned\ downtime}{Total\ available\ time - Planned\ downtime}$$

$$Productivity (\%) = \frac{(Good\ parts + Bad\ parts) \times Cycle\ time}{Total\ available\ time - Unplanned\ downtime - Planned\ downtime}$$

$$Quality (\%) = \frac{Good\ parts}{Good\ parts + Bad\ parts}$$

Working with OEE (as well as with TPM) involves understanding the eight big losses, see Figure 4.4., concerning availability, performance, and quality. These should be analyzed with the help of pareto analysis and utilized for improvement planning.

<sup>113</sup> REACH, *TPM*, 2009.

<sup>114</sup> REACH, *OEE*, 2009.

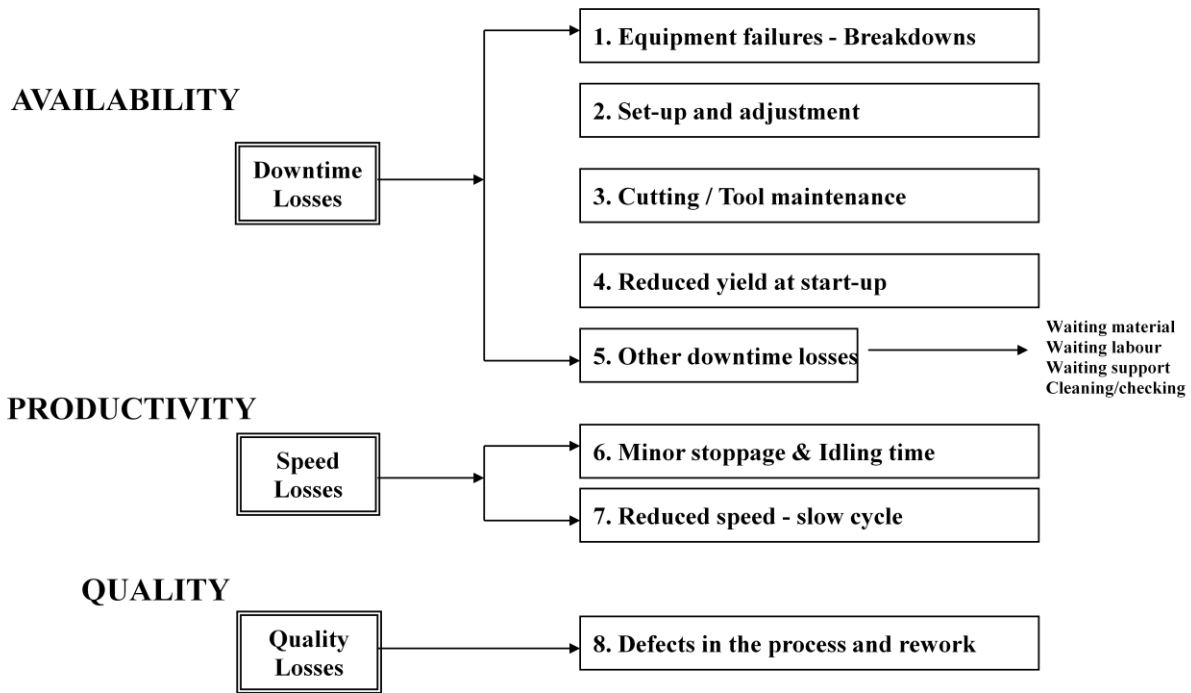


Figure 4.4. The eight big losses.<sup>115</sup>

**Continuous improvement teams** Silver Gold

Continuous improvement teams is a further development of the categories Cell team and Cross-functional teams and this category exists to ensure that all teamwork results in continuous improvement activities for the entire business. This category also promotes the LDMS (Lean Daily Management System) as an activity that has positive effect and impact on the team goals and objectives.

A LDMS meeting is a structured meeting with a defined frequency to fit the volatility of the function/process designed to enhance the efforts of an intact work group and increase the speed of continuous improvements. The intact work group involved in the LDMS meeting should consist of employees who work on similar, related, or connected processes and the stand-up meeting, lasting approximately 10 minutes, should be conducted in the work area in front of a display board.

**Full value streams** Silver

Full value streams is a further development of the Value stream mapping and Process mapping categories. Focus in this category is on the full value stream, from suppliers, through Haldex' site and through to the final customer. These value streams should all be mapped and activity lists with items for improvements, detailing implementations plans should exist.

**Balanced flow** Silver

Balancing flow is about evenly distributing activities between the different processes in the flow. A balanced line implies an effective resource management, simplifies process management and is the basis of control to spot abnormal conditions or practice. For this category work sequences are identified, defined and time measured and balance of the processes should have been performed.

<sup>115</sup> REACH, TPM, 2009.

### **Product development** Silver Gold

Product development is the first, out of two, more functionally oriented categories. Focus is entirely on the process of product development and this category translates Haldex Way into practical, specific working methods for R&D. For example; APQP (Advanced Product Quality Planning), a framework of procedures and techniques to develop products particularly used in the automotive industry, should be used. Products and processes should also have full PPAP (Pre-production Part Approval Process) documents, making sure that all customer engineering design and specification records are understood and that manufacturing process has the potential to produce the product consistently meeting the requirements. With this category one also wants to make sure that the customer as well as the supplier is part of the design and development process.

### **6 Sigma** Silver Gold

This category promotes the use of 6 Sigma as a powerful problem solving method to be used to accelerate improvement throughout the business where other methods have failed. 6 Sigma is a measure of variability, a name given to indicate how much of the data that falls within the customers' requirements. The higher the process sigma, the more of the process outputs, products, and services meet customer's requirements or in other words, the fewer the defects. (A sigma level of 6 means 3.4 defects per million opportunities whereas a sigma level of 2 corresponds to 308 537 defects).

### **Quality** Silver Gold

Quality is the second, out of the two, categories which are slightly more functionally oriented. This category exists to support quality work for manufacturing sites (non manufacturing sites will not be audited on this category) and it was originally developed to ensure that sites have a working quality system and that ISO/TS certificates were not obtained as a "paper exercise". Regarding many aspects this category also has higher requirements compared to the ISO/TS certificates.

### **Takt & Balanced Flow** Gold

This category is a combination of the earlier Takt and Balanced flow categories and stresses the importance of addressing deviations from Takt time and making sure that all value streams (in production as well as administration) are balanced. All employees within the work area should also be involved in the work of balancing and improving the work flow as well as that they are empowered to make decisions within their defined boundaries.

### **Process stability** Gold

Process stability involves measuring and tracking deviations from stable production and administration processes. Minor process deviations of the core processes should be monitored daily and actions should be taken to prevent these from happening. OEE trends should be available and they should be calculated using the Haldex standard for OEE.

### **KPIs** Gold

This category has much in common with all the previous categories concerning KPIs (KPI reporting, Site KPI, and Process KPI) and supports working with KPIs, also at higher levels such as the Gold level. Focus here is on that workgroups, cell teams and departments have developed relevant KPIs for their processes (same as for Process KPI), and that goals are developed and reviewed regularly and that they are defined and owned by the people within

the process. Finally all site KPIs should be traced to the individual process KPIs and links between them should be aligned with overall goals of the site.

## 4.2 The KPIs

Along with the different criteria all sites are also assessed on eight Haldex Way Tier level KPIs. These are as follows<sup>116</sup>:

- *Inventory Days* – the ability to manage inventory levels at the lowest level possible.
- *Delivery Performance* – the ability to deliver to customers on time.
- *First Time Pass Rate* – evaluating the quality performance of processes.
- *Zero km Returns* – evaluating the quality output performance of the value stream.
- *Time per Unit* – a measure of productivity and correct personnel in relation to the current demand.
- *Value Added Ratio* – a measure of optimized work distribution and utilization of resources in order to create the most value.
- *Warranty Cost of Total Sales* – a measure of the ratio between warranty costs and sales.
- *Return On Capital Employed* – a measure of the health of the business to help develop strategies for managing the business.

The KPIs exist to ensure a continuous, accurate and reliable measure of each of the issues above, they are all used to monitor performance and identify deviations. The provided data should also be used for root cause analysis, identifying improvement activities and later tracking results.

## 4.3 Implementing a Business Excellence model

As of today the concept of Business Excellence is not widely spread across the different Haldex sites. Only one site is actively working in accordance with a Business Excellence model and apart from that site only a handful of people are involved in projects regarding Business Excellence models.

### 4.3.1 Study visit in Birmingham

In order to practically see how Business Excellence can be integrated with Haldex Way, a study visit to the Haldex Concentric Pumps site in Birmingham was conducted. This site was acquired by Haldex some 2 years ago and had previously been using the EFQM model as their continuous improvement system. During this visit we had the opportunity to meet several employees (e.g. Operations Director, HW Site Coordinator, Supply Chain Manager, Programme Manager, and Business Excellence Coordinator) and receive their view of how Haldex Way is applicable to their part of the business. A further analysis of this visit can be found in Section 5.7.

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<sup>116</sup> REACH, *HW KPI Standards*, 2010.

#### 4.4 Gold Tier Enterprise Management System (GTEMS)<sup>117</sup>

Although the principles of Lean work just as well in administrative processes their origin from a production environment have resulted in an extensive use of production terminology. This in combination with the fact that the Tier model mainly focus on site level and does not directly address enabling and supporting processes have resulted in the need for a more accessible and supportive structure. To resolve this and to act as a complement to the Tier model, the Gold Tier Enterprise Management System (GTEMS) was developed at Haldex. GTEMS is directly applicable on administrative processes on all business levels and the goal is to provide guidance towards world class performance in enabling and supporting processes. The deployment of GTEMS lies in the seven categories of improvement for processes that are assessed in a challenge, much like in the Tier model. The categories of improvement are listed below:

- Process Understanding and Improvement
- Voice of the Customer and Voice of the Business
- Process Management
- Standardized Work
- Process Performance
- Process Competence
- Best Practice

A challenge document with similar structure as the Tier model, form the base for the challenge. GTEMS will act as a link between the Tier model's Gold level and the fifth Platinum / Business Excellence level, see Section 5.8. The "Gold" in the name "Gold Tier Enterprise Management System" indicate that requirements in the GTEMS are at a level equal to the site Gold Tier, but structured according to processes.

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<sup>117</sup> REACH, *GTEMS Awareness presentation*, 2010.

## 5 Analysis of the Tier model

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*In this chapter the analysis of the current Tier model is presented. The analysis is based on the information in the frame of reference and empirical chapters and not to belittle, a series of interviews with employees and various site visits. Overall, the analysis is conducted with the help of the frameworks presented in the methodology chapter.*

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### 5.1 Structure of the current Tier model

According to Kotter, in order to obtain successful change, any structure that will undermine the vision will need to change, see Figure 3.6. Hence, the lack of a clear and comprehensible structure will risk obstructing the deployment and progression of the Haldex Way Tier model.

#### 5.1.1 Horizontal structure

When analyzing the current Tier model the lack of a clear structure of the different categories is obvious. The lack of a horizontal structure makes it hard to follow a site's progression for most categories, see Table 4.1. Also, without a clear horizontally oriented structure, aligning the criteria to fit appropriately in each level in the Tier model is very difficult.

With the current structure it is hard to, in an accessible manner, see the journey that lies ahead in each category. Also, it is difficult for a site to look back at earlier levels and see the great improvements they have accomplished by comparing their current performance against what was requested at the lower levels. The latter has been explicitly asked for during interviews as it is difficult for employees to remember what was and seeing how much better performance has become at the site in just a couple of years.<sup>118</sup>

##### 5.1.1.1 Core themes of the categories

A result of the gradual development and lack of consensus definitions is the existence of several categories that share the same features and core themes but have different names. Due to the large amount of categories in the Tier model it is easily perceived as fairly unorganized. The different categories consist of a mix of tools and principles, but also of two processes/functions (Quality and Product development).

In order to understand the underlying intention and purpose of the current Tier model an analysis identifying the core themes and concepts of the current categories was conducted. What was found is that some of the core themes are evident in the current Tier model as categories of their own, while others are split into a range of different categories. Below we will identify opportunities for consolidation.

#### **KPIs**

One major theme identified concerns the work with Key Performance Indicators (KPIs), which today can be found in the categories "KPI reporting", "Site KPIs", "Process KPIs", and "KPIs". The KPIs are the Tier model's most prominent tool for measuring performance and it is hence of great importance that the Site KPIs have a clear link to the overall strategy to ensure a uniform direction of improvement activities. One should also bethink the lemma "what gets measured, gets done" and reflect over whether the existing criteria drives the behavior wished for.

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<sup>118</sup> Interview with Haldex Way site coordinator.

### **Haldex Way values**

Another major theme identified concerns the Haldex Way values. Today Haldex Way values can be found in the “Education”, “Steering committee”, “Principles & Values” and “Go & See” categories. As the Haldex Way values are of utmost importance they will be discussed in a separate section, see Section 5.6.

### **Teamwork**

Teamwork is a fundamental part of the Haldex Way and can be found in the Haldex Way house, see Section 3.4.2.2 . In the current Tier model three team concepts (and categories), exist; “Cell teams”, “Cross-functional teams” and “Continuous improvement teams”. The three concepts are however not clearly defined in any standard and consequently there have been recurring discussions about what constitutes a cell team, a cross-functional team etc. We believe that the concept of teamwork must remain a fundamental part of Haldex Way, this in line with Jones *et al.* statement about Lean, “that all activities should be team based”, see Section 3.2.1, but be made clearer.

### **Visualization**

Visualization is a wide and generic concept, it is also one of the ten principles of Haldex Way (see Section 3.4.2.1.). The main parts of the concept can be found in the categories “Communication” and “Visualization”, and the reason for this difference in terminology is due to the lack of consensus definitions during the development of the Tier model. Agreeing on a consensus definition for all issues concerning visualization, etc. would benefit the understanding and development of the concept.

### **Takt & Balanced flow**

It should be of no surprise that the current categories “Takt”, “Balanced flow”, and “Takt & Balanced flow” all concern issues regarding Takt time and balancing of flows. And as they are conceived today it would be a natural progression to start with understanding Takt time and pacing output according to it, before looking deeper into the production process and start balancing the different production activities. Why they exist as separate categories today have most certainly to do with the gradual development of the Tier model.

### **Total Productive Maintenance**

At Haldex, Total Productive Maintenance (TPM) is a broad concept concerning operator, but also specialist, maintenance. The main ambition with TPM is to achieve operator ownership and pride in equipment by everyone and thereby improve equipment condition and overall effectiveness, see Section 4.1.7. This is obtained by engaging employees in preventative maintenance activities within their own processes and the utilization of OEE to analyze how well the equipment is performing in order to address correct maintenance work. Haldex have recently developed a well-documented and standardized seven-step TPM approach that needs to be utilized to a greater extent. In the current model, criteria concerning TPM can be found in the categories “Preventative Maintenance”, “TPM & OEE”, “TPM”, “OEE”, and “Process Stability”.

### **Mapping**

Mapping is a valuable tool for understanding the business and the processes within the business. Since Process mapping and Value stream mapping both are tools to facilitate understanding and improvements of a business’ processes and value streams they should preferably be included in the same category and not in three different as of today; “Value stream mapping”, “Process mapping & Value stream mapping” and “Full value streams”.

### 5.1.2 Vertical structure

Looking inside the categories, we have examined the structure of the criteria, which we refer to as the vertical structure. What we found is that there exist no clear vertical structure and this may hide the fact that some criteria overlap and thereby add complexity rather than value. More importantly, without an evident structure it is hard to see if a category is lagging in areas such as method, implementation or result. It is also clear that many categories are weaker in some areas, the lack of leadership/management being the most evident, something that has also been identified during interviews.

Adding a clear vertical structure would facilitate the deployment of the tools and methods in Haldex Way. Further, it would ease the understanding and shorten the learning phase of a new level as one would become familiar with the structure. Last, but not least, the Business Excellence models use clear vertical structures (such as EFQM's RADAR structure) and adding such a structure will create support and ease the deployment of such a model.

## 5.2 Prescriptive / non-prescriptive split

How prescriptive the model should be in its different levels is a delicate balance between providing structure and guidance and risking forcing sites to use tools and methodologies that is of low priority. At the Copper level, the main purpose is to get the site onboard, and hence, providing sufficient support is of utmost importance. As sites progress in the Tier levels, their increased maturity and understanding of the potential results that can be achieved would allow for higher responsibility in choosing appropriate and suitable tools to tackle the improvement initiatives that are undertaken. Being too prescriptive in the later levels would inhibit the progress of higher prioritized initiatives. The current Tier model handles the prescriptive/non-prescriptive split fairly well, with a few exceptions:

The 'Set-up & Change-over' category has received a lot of critique during interviews and observations, with the forced use of the Single digit Minute Exchange of Die (SMED) methodology in the higher levels being the main reason. A site is supposed to use the SMED methodology, but no concern is taken whether set-up times are a big part of the OEE losses, or even if the set-up time lies within the Takt time, thus eliminating the benefits of using SMED. This is a straightforward and classic example of where being too prescriptive can hold back rather than help progress.

6 Sigma is another category that has received a lot of critique. One reason is that in the Silver and Gold levels very specific criteria are found telling a site what number of Black Belts they need, specific savings (without any correlation to site size) that should have been obtained from 6 Sigma projects, etc. The criterion is not only very specific but also very hard to obtain, for instance a production site with 25 employees needs to have one full time Black Belt working. We would agree with the general critique presented by many quality practitioners in the literature; that the large focus on specific results is violating several of the ideas developed by Deming for continuous improvement.<sup>119</sup> Many sites on higher Tier levels do not have a very active 6 Sigma utilization, a better structure providing added support, flexibility and time for deployment would hopefully create more buy-in and thus ease implementation.

There is also an obvious risk with being too non-prescriptive. By not forcing a site to investigate what benefits they would draw by using a specific tool/methodology many would choose not to use it, simply because it would be the easiest way to go. This would also be the

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<sup>119</sup> S.T. Foster, *Managing Quality*, p.424.

case if enough flexibility was added for a site to choose not to use it. They would argue that the tool/methodology is not applicable to their business due to their unique characteristics. According to a Haldex Change agent, one would be surprised of how often they would find benefits if they just invested a little time in learning how to apply it to their business.<sup>120</sup> It is important to realize the need for a site to provide appropriate arguments for why they would chose not to use a certain tool.

### 5.3 Functionality in different parts of the business

By adding more specific goals and evidence, functionality for all parts of the business is easily diminished. If, during the deployment of the Tier model, employees find criteria that cannot be applied to their specific function, it is likely that they fall back on the argument stated earlier, that the methodology is not applicable for this function/process. Remember:

*When adding, you are also excluding.*

When adding function/process specific categories such as the Product development and Quality categories found in Silver and Gold, functionality for all parts of the business is definitely diminished. Many would argue that there is a need for a Supply Chain or a Customer service category, but if adding these, is there not a need for a Human Relations category? Or an IT/IS category? There would be an overhanging risk of finally ending up with categories covering the entire business and a model so specific that it would only be applicable for very few sites.

In essence, there are two ways to go to improve functionality, one is to add categories to cover all relevant processes/functions in the business and how they should work with Haldex Way. The other is to reduce the number of categories, eliminating the process/function specific categories and making the Tier model generic enough for the entire business. One should also bear in mind that making the model more generic would add support for the Business Excellence models.

The concept of Lean production, the foundation of Haldex Way, has a strong production-oriented focus. Many of the tools and principles have been developed for production processes and hence terminology is often better suitable for the improvement of production processes. But any process can draw great benefits from the use of Lean tools and methodologies and the Haldex Way has the ambition to be an “overall management and process improvement system”.<sup>121</sup> Although, sometimes it is easy to get lost in translation, e.g. in the original Gap analysis tool no specific questionnaire was used for administration areas, hence personnel in for instance the Human Resources (HR) department were assessed on if they had they correct floor marking for forklift lanes.<sup>122</sup> Again, here it is easy to fall back on the “not-applicable argument” without having realized the intention and potential and hence hold back the deployment of Haldex Way throughout the facility.

In the Tier model, support for production areas is strong, while the support for administration areas is lagging. While the administration may be a smaller part of the total budget, their work cast a big shadow on the total result. The adding of better support for administration areas is vital for obtaining maximal benefits of the Tier model.

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<sup>120</sup> Interview with Haldex Change agent.

<sup>121</sup> Haldex Annual Report 2009.

<sup>122</sup> Interview with Haldex Way site coordinator.

To summarize; it is important to bear in mind when adding specific goals, categories and criteria, that usability for all functions need to be considered.

### 5.3.1 Supply Chain Management

The philosophies behind Lean and Business Excellence involve partnerships with both customers and suppliers in the day-to-day work, as well as the long-term strategic work (see Section 3.1. and Section 3.2.). Today support for supply chain management is weak and criteria concerning building and sustaining partnerships are hard to find, it is therefore important to strengthen the perception and importance of supply chain management in the Tier model. The lack of supply chain management is very unfortunate since excellent material concerning supply chain improvement activities, such as the Haldex Supplier Handbook and the Supply Chain Improvement Program (SCIP) exist at Haldex. One must not forget the characteristics of the automotive industry where excellent delivery performance is a prerequisite for being considered for business.

### 5.4 Standards and consensus definitions

The concept of Lean production is continually evolving, and “any definition of the concept will only be a still image of a moving target”, consequently, this is also the case with Haldex Way.<sup>123</sup> The tools and principles of Haldex Way have evolved and been refined over the years, concepts have been given clearer definitions and the work with standard documents has come a lot further. Since the different levels have been added gradually, the evolvement of Haldex Way is evident in the formulation of criteria and referral to standards over the Tier levels. The need for consensus definitions is however important since this can help bridge communication difficulties, and help defining overall goals of the Haldex Way, as discussed in Section 3.2.

The lack of standards and consensus definitions has resulted in the need for clarifications of some of the criteria to reduce risk of ambiguity and faulty interpretation and this contributes to an inhomogeneous feel of the challenge documents.

Opinions regarding in which Tier levels it is most appropriate to use standards are divided among interviewees, some argue that it is most important in the lower Tier levels where the model should be prescriptive.<sup>124</sup> Others argue that it is ok to allow some flexibility in the lower Tier levels, while in the Silver and Gold levels, one should have realized the need to use the Haldex standards.<sup>125</sup> It is of our firm belief that standards are equally important throughout all levels and they should be used wherever appropriate. To us, it is rather the standards themselves that should be good and generic enough to allow for use over all levels in the Tier model.

A better support for standards in the Tier model would provide a common language that will bridge communication gaps, it would provide best practice procedures that would facilitate the deployment of Haldex Way and reduce the risk of managers getting stuck in an alphabet soup of initiatives and thus lose their focus, see Section 3.3.1. A better support for standards would also form a learning organization, e.g. the introduction of standards (LDMS, TPM and

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<sup>123</sup> J Pettersen, ‘Defining Lean Production: Some conceptual and practical issues’, 2009.

<sup>124</sup> Interview with Haldex Change agent.

<sup>125</sup> Interview with Haldex Change agent.

KPI definitions), although disputed by many, have improved the overall level of performance where implemented and led to discussions to further improve the standards.<sup>126</sup>

Standards and consensus definitions regarding categories are also important. An example of a category that often has caused discussions due to its name and definition is the Poka Yoke category. As mentioned in Section 4.1.7, the concept has been widened and should therefore more appropriately be named Error-proofing, which include Poka Yoke, but is more generic.

## 5.5 What tools are used in what levels

Another side-effect of the gradual development of the Tier model is that some tools and concepts are introduced too late, or in a reversed order. As Haldex Way has evolved, the importance of tools and concepts has been realized and hence tools have been added in the Tier model at the level that was currently being developed without updating lower levels. Not introducing tools and principles in an appropriate order risks obstructing the progression of Haldex Way. Adding tools and concepts too late will also risk obstructing the progression as implementation times can be very long, and sites generally only start to look at the next level in the Tier model when a challenge has been passed for the current level.

To facilitate progression, we consider it important that all categories are introduced at an early stage (with lower requirements) and that they range over all levels, this will allow sites adequate time to mature within each concept. Below, some areas for improvement are highlighted.

### **Process Stability Procedure**

A prerequisite for a successful OEE initiative, which in turn is the foundation for TPM, is stable processes. If you do not have stable processes your OEE data will not be accurate and it will be hard to follow TPM progress. At Haldex, a project-based program for obtaining process stability and introducing OEE exist, the Process Stability Procedure. Unfortunately, this program is introduced first in Gold, when its need is most evident in the lower levels to create a foundation to build a TPM/OEE initiative on.

### **6 Sigma**

The powerful process improvement concept of 6 Sigma is often found extremely useful for tackling difficult process quality issues. It is also very resource-demanding and requires substantial amount of man-hours in training. Implementation time can consequently be long. In the current Tier model, 6 Sigma is introduced first in Silver and considerable results are to be shown. We fear that this giant leap from not working with 6 Sigma in the Bronze level and the high results demanded in Silver will obstruct the progression and create resistance towards the Tier model.

### **Mapping**

Today two mapping methodologies exist; Value stream mapping and Process mapping, where VSM is introduced first. We believe the other way around would be better since Process mapping and understanding the processes within your site is easier than focusing on the more abstract information flows and extending the focus outside the site.

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<sup>126</sup> Interview with Haldex Change agent.

## 5S

5S is a system for identifying and eliminating waste, see Section 4.1.7. In short, the first three S's concern sorting, organizing and cleaning whereas the last two concern standardizing and setting a system for continued work. In the current Tier model, when facilitating the implementation of the system, the 5S's have been split so that the first three S's are first implemented throughout the site in the Copper level and the other two at a later level. Taking a closer look at the system, one would realize that this is not a good idea. Plotted below, see Figure 5.1., is the 5S performance over time when only 3S's are implemented. The initial cleaning, sorting and organizing will provide a major initial boost in performance. But since no system or standard is set for continued work, performance will degrade and soon be back at the initial level. Often, it can be at least a year between a challenge of Copper and Bronze and performance would hence most certainly decline. Plotted in Figure 5.2., is the performance over time, if all 5S's are implemented at the same time. In facilitating the deployment, it would be better to start with all 5S's, but in a pilot area. The pilot should, for best result, not be implemented in an area that is remote or has little in common with the rest of the business, it should rather be implemented in one of the main areas. This to mitigate the risk noted by Huy that "successful pilot site experiments rarely spread, for their very success generates defensiveness and rejection by other business units claiming that they are different", see Table 3.4.

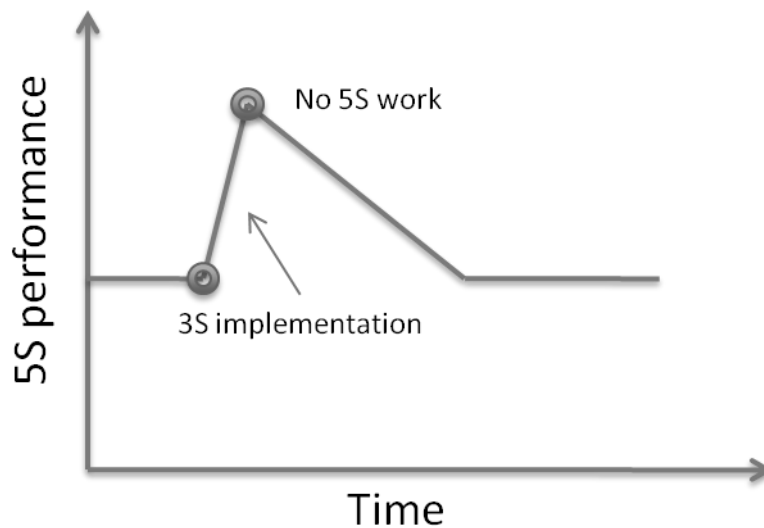


Figure 5.1. 5S performance if 3S's are implemented.

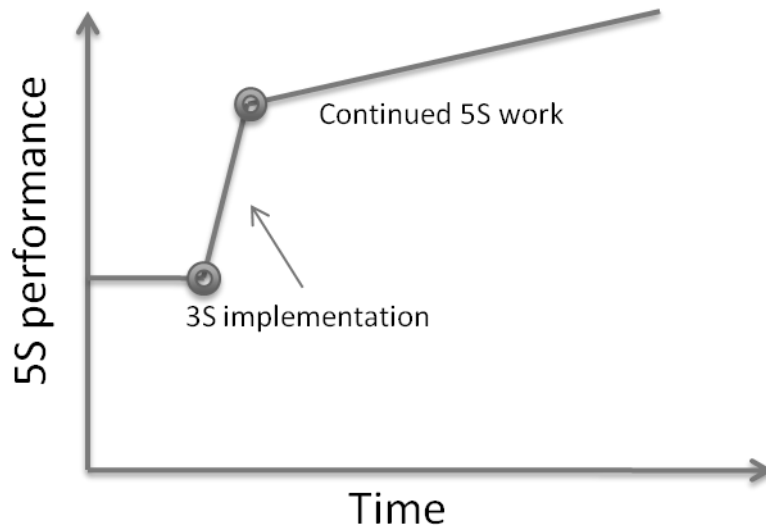


Figure 5.2. 5S performance if all 5S's are implemented.

### Gap analysis

The Gap analysis tool was developed prior to the Tier model and they have similar purposes, to drive progression in Haldex Way and identify areas for improvement. It is a useful and powerful tool for identifying improvements, but it is quite resource-demanding. Since the Tier model, and particularly the later levels, were developed several years later than the Gap analysis tool the maturity level of the higher levels in Tier model is higher than for the Gap analysis. We find the Gap analysis a useful tool for the lower levels in the Tier model as it identifies areas for improvement in a direct and accessible manner, but for the higher levels the Gap analysis is redundant.

### 5.6 Haldex Way values

According to Petterson there are two main approaches towards the concept of Lean, either Lean is perceived as a set of tools for reducing waste, or it is seen with a more philosophical approach as a management philosophy, see Section 3.2. Spear *et al.* argue that implementing a system such as the Toyota Production System or Haldex Way requires a substantial cultural change, see Section 3.2.3., and the governing principles makes for one out of four main building blocks in the pyramid described by Liker, see Figure 3.4.

Haldex perceive Haldex Way as an overall management philosophy and consequently it is much more than just the tools used.<sup>127</sup> The core values constitute the foundation of Haldex Way and should be treated accordingly. With the Tier model's strong production-oriented focus the "Elimination of waste" core value tend to get too much focus, whereas the "Customer first" and last, but not least, the "Respect for individual" core values are lagging. It is of utmost importance that all three core values are evident in the Tier model, one reason being to add support for a Business Excellence model being added as a fifth level.

<sup>127</sup> Haldex Annual Report 2009.

## 5.7 Support for a Business Excellence model

When comparing the Tier model to the nine criteria of the EFQM model and the seven categories of the MBNQA model, (see Section 3.1.), it is evident that much can be improved in the Tier model to add support for the introduction of a Business Excellence model. In order to create better support more focus on issues such as leadership, partnerships, and people management/workforce is needed. As organizations “ultimately learn through their individual members” (see Section 3.3.2.), it is also important that support for a Business Excellence model is obtained throughout the organization. Improving these areas would also support a shift towards change management theory O, where the goal is to “develop corporate culture and human capability through individual learning” and in this way strengthen the organizational capability (see Section 3.3.2.).

A clear vertical structure in the improved Tier model, similar to the RADAR framework used by EFQM (see Section 3.1.1.), would also ease the adaptation to, and prepare employees for the modus operandi of a Business Excellence model. This support should be introduced early, and be evident throughout the Tier model in order to give people time to adapt their way of thinking to the concept and hence ensure that the strive for a Business Excellence award is not just for the sake of winning an award (see Section 3.1.3.).

With theoretical insight in the implementation of a Business Excellence model, our visit to Birmingham and the consultation with a Business Excellence coordinator proved useful. The outcome was, however quite expected. The first, and presumably the most important step would be to create better support for leadership with the focus on creating clear links from the overall strategy to the implementation of tools. A stronger link to the overall strategy would give a better understanding of why we are doing what we are doing and this would be in line with the Business Excellence model way of thinking. Another important step is to capture the voice of the customer from an early stage, as a Business Excellence model has strong customer focus, this would also strengthen the “customer first” core value. Finally, a stronger people management is needed, as “people” and “people results” are a major part of the Business Excellence model.

We would also like to emphasize how well the Haldex Way Tier model, with its strong focus on tools and methodologies will complement the use of a Business Excellence model. A set of well implemented Lean tools and methodologies is almost a prerequisite for a production site implementing a Business Excellence model successfully. Illustrated below is how a set of well implemented Lean tools and methodologies will leverage the performance of a Business Excellence model, see Figures 5.3. and 5.4.

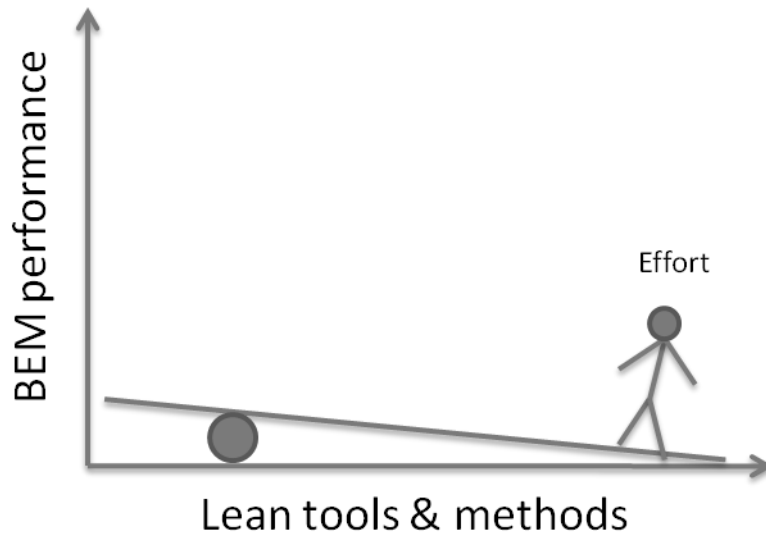


Figure 5.3. Business Excellence model performance with low level of Lean tools implemented.

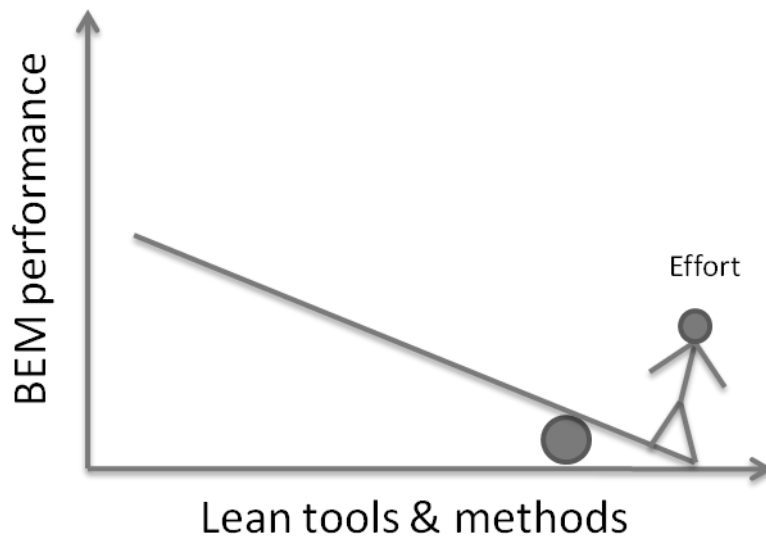


Figure 5.4. Business Excellence model performance with high level of Lean tools implemented.

## 5.8 Gold Tier Enterprise System (GTEMS)

Utilizing the GTEMS has proved major benefits compared to only working with the Tier model.<sup>128</sup> GTEMS has a strong process oriented view and makes sure that collaboration between different functions is enhanced and that all functions is part of the improvement work. Sharing the strong focus on processes, GTEMS can be seen as a natural link between the Tier model and a Business Excellence model. It is of our belief that the GTEMS works satisfactory today.

<sup>128</sup> Interview with Haldex Way site coordinator.

## **5.9 What should be required at each Tier level**

An important part of facilitating the deployment and progression of Haldex Way is aligning the different Tier levels to an appropriate difficulty level and provide a clear path towards the final goal. To aid in this alignment, we developed the matrix in Figure 5.5. It depicts the general requirements for each level and will provide help when ensuring a coherent step length between levels and thereby a more natural progression. Also, it will provide a brief and lucid overview for what is requested at each level and increase awareness and understanding of the progression of Haldex Way.

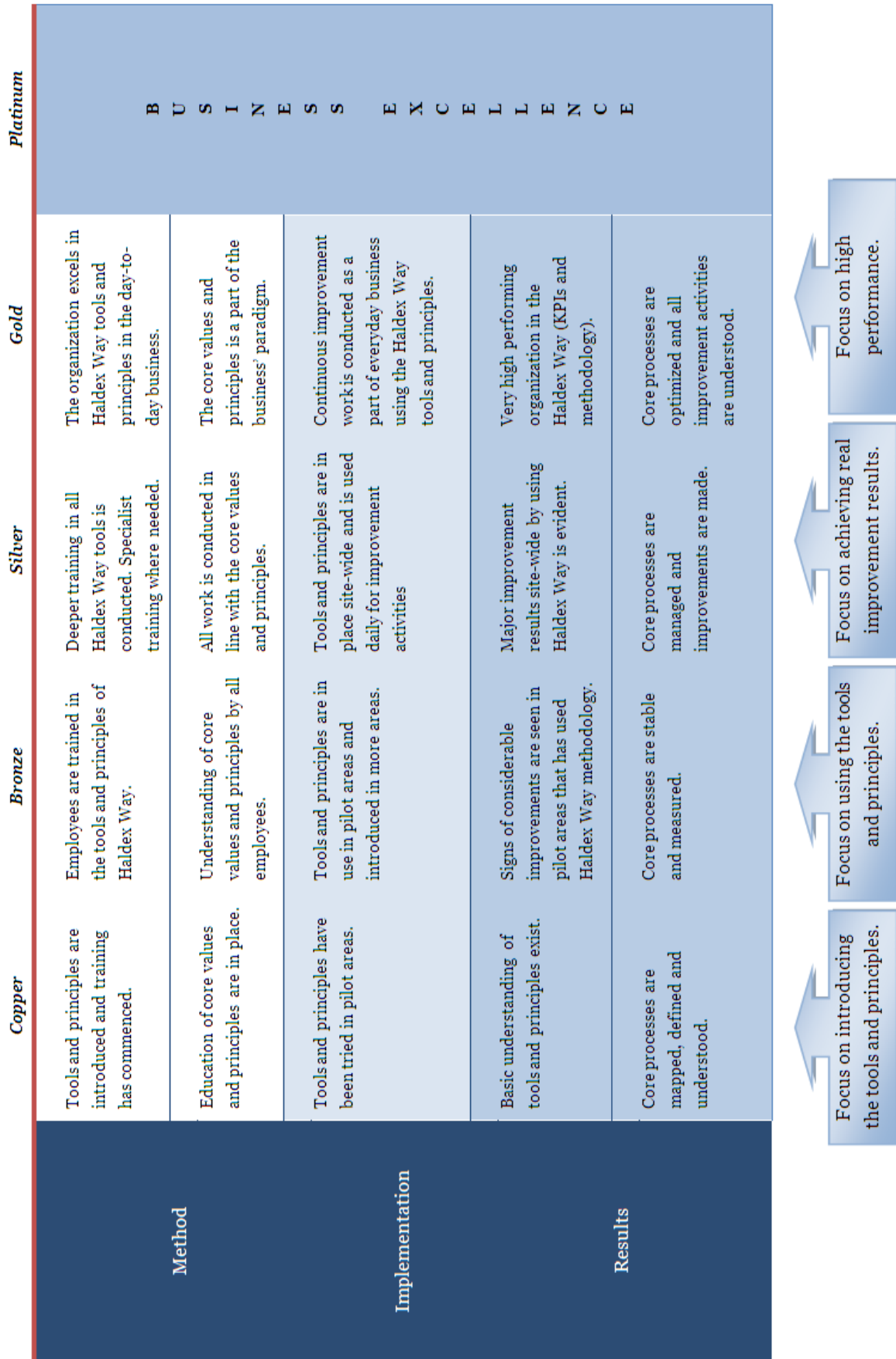


Figure 5.5. An overview of the Tier model.

## 5.10 New Tier improvements

Summarizing the analysis is a list of the improvements that would prove most useful in the current Tier model. The listed bullets will also form the headlines in the results chapter to ensure that each area for improvement is covered.

- Reduce the number of categories and improve the horizontal structure
- Add a vertical structure to ease implementation, speed of progression and development of each category
- Allow the Tier model to be more generic in the later levels, i.e. add some flexibility for how and when tools etc. are used/prioritized
- Introduce consensus definitions and enhance support for existing standards
- Introduce necessary tools and methods at an appropriate level
- Strengthen the visibility and support for the core values and principles
- Enhance support for administration areas
- Increase support for leadership/management
- Relocate the Product development and Quality categories to run through the remaining more generic categories
- Improve support for supply chain management
- Improve overall layout

### 5.11 Benchmarking against Volvo Production System (VPS)<sup>129</sup>

In order to achieve an understanding for how Haldex Way compares to other companies' similar frameworks we have had the opportunity to benchmark it against the reputable Volvo Production System. The benchmarking study was conducted after major parts of our analysis had been conducted and the intention have therefore been to verify and validate our suggested improvements with the existing system at Volvo. Focus in the study lied in comparing the VPS assessment scoring model with the very similar to the Haldex Way Tier model.

The assessment scoring model is based on the VPS pyramid, which consists of five principles and the underlying "The Volvo Way", see Figure 5.6.

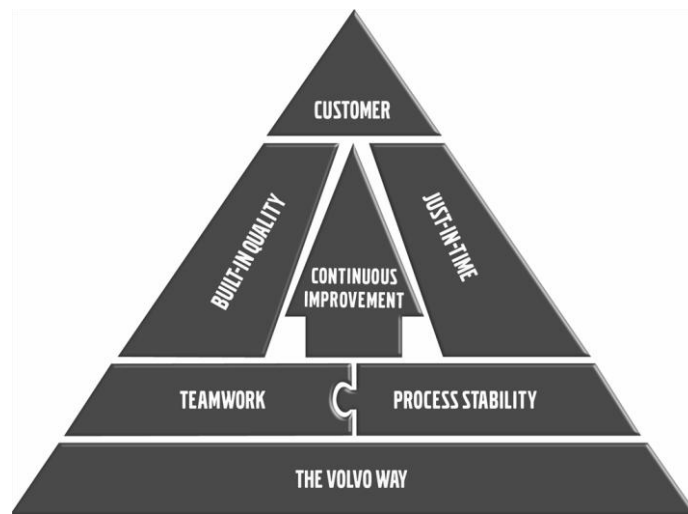


Figure 5.6. The Volvo Production System.<sup>130</sup>

This pyramid is then divided into 22 different modules, similar to Haldex Tier model's different categories. Each module have five levels, level 1 to level 5, similar to the Copper to Platinum levels of the Haldex Way Tier model. Focus in the lower levels is to implement basic initiatives in pilot areas whereas in the higher levels initiatives should be established in all areas. Level 5 represents "perfection" and equals being top five in the world, which makes it very hard to reach this level. Each module is assessed on its Approach, Deployment and Effect, similar to EFQM's RADAR structure or the GTEMS structure of Method, Implementation and Result. The general impression is that the two models share many core features, weaknesses and strengths.

Conducting the benchmark and finding so many similarities, both regarding the assessment model itself and the areas of improvements, gave us confidence that the suggested "New Tier improvements" will be a step in the right direction. Worth mentioning is the validation of the developed matrix (see Figure 5.5.) as we found a very similar assessment-guide in the VPS. As mentioned, focus lied in validating the improved Tier model and as no major weaknesses were found, no changes to the improved Tier model were made.

<sup>129</sup> Interview with consultant.

<sup>130</sup> Volvo Production System, [http://www.volvo.com/constructionequipment/corporate/en-gb/quality/product\\_life\\_cycle\\_quality/manufacturing\\_quality/manufacturing\\_quality.htm](http://www.volvo.com/constructionequipment/corporate/en-gb/quality/product_life_cycle_quality/manufacturing_quality/manufacturing_quality.htm), viewed on 28 September 2010.

## 6 Result

*In this chapter the major parts of the redesign of the current Tier model will be covered. Redesign has been conducted according to the guidelines below. Only major parts of the change process will be covered. In order to see all changes made, a comparison between the current and the improved Tier model is needed.*

### 6.1 Guidelines for redesign

Throughout the redesign process, the methodology illustrated in Figure 2.2. has been used. In addition, a set of general guidelines have been utilized. First, alignment against the developed matrix illustrated in Figure 5.5. has been ensured to the largest possible extent. Secondly, the list of improvement goals in Section 5.10 has been dealt with one by one to ensure that all goals are obtained. Finally, when redesigning the Tier model we have tried to create as much “bang-for-the-buck” as possible, i.e. create as much improvement as possible by changing as little as possible. This is for several reasons, the main being to create buy-in for the improved Tier model. Many sites have been working hard on achieving the next level in the Tier model and would be demoralized and resistant to the introduction of a completely new model, also the Tier model is well-known throughout the organization and has strong support. Throughout the redesign process consideration of how to align the model to a Business Excellence model has been taken and when criteria needed to be added in the Gold level these were aligned with criteria in a Business Excellence model.

### 6.2 Reduce the number of categories and improve the horizontal structure

In the improved Tier model, a new horizontal structure has been developed. The new structure was created by introducing a set of more generic categories that cover the core themes, tools and principles of the current Tier model. Categories with similar core themes and apparent coherence have been grouped together, criteria have been added, relocated, split and merged and in total the number of categories have been reduced from 33 to 13. Now each category also ranges across all levels. The new structure is illustrated in Table 6.1.

**Table 6.1. The improved Tier model structure.**

KPIs	Copper	Bronze	Silver	Gold
Haldex Way Values	Copper	Bronze	Silver	Gold
Teamwork	Copper	Bronze	Silver	Gold
Visualization	Copper	Bronze	Silver	Gold
Standardization	Copper	Bronze	Silver	Gold
Takt & Balanced Flow	Copper	Bronze	Silver	Gold
Consumption control	Copper	Bronze	Silver	Gold
5S	Copper	Bronze	Silver	Gold
TPM	Copper	Bronze	Silver	Gold
Mapping	Copper	Bronze	Silver	Gold
Set-up & Change Over	Copper	Bronze	Silver	Gold
Error-proofing	Copper	Bronze	Silver	Gold
6 Sigma	Copper	Bronze	Silver	Gold

### **6.2.1 The new categories**

The new, now more generic, categories with their respective content and origin will be discussed briefly below.

#### **KPIs**

“KPIs” is a consolidation of the current categories “KPI reporting”, “Site KPI”, “Process KPI”, and “KPIs”. In this category, referring to either Site KPIs or Process KPIs rather than listing different specific KPIs will provide a consensus definition and make it easier to change KPIs without rewriting criteria. Further, a stronger link to the overall strategic plan is achieved by better linking goals for KPIs to the multiyear Haldex Way implementation plan or the Strategic plan. Procedures for reporting and development for relevant KPIs are referred to by standard instead of explicitly being explained in the criteria. Referral to Stockholm headquarters is substituted with “Global headquarters” for the future scenario of Stockholm not being the headquarter.

#### **Haldex Way Values**

“Haldex Way Values” is a consolidation of the current categories “Education”, “Steering committee”, “Principles & Values”, and “Go & See”. The name “Haldex Way Values” is preferred rather than “Principles & Values” to avoid confusion with other categories such as “Visualization”, “Standardization” and “Consumption control” which are all Haldex Way principles. Some of the major changes include the introduction of an employee survey, better support for the standardized employee orientation program, and strengthened use of the multi-year Haldex Way implementation plan.

#### **Teamwork**

The new category “Teamwork” is a consolidation of the current categories “Cell team”, “Cross-functional teams”, “Continuous improvement teams” and “Gap analysis”. The Gap analysis tool have been included here as a way of ensuring that this tool will not be given too much focus. In the current categories, a range of different team definitions was used, we believe that the use of the more generic term “teams” and “teamwork” but with clearer explanation of what is requested would reduce complexity and ease deployment and has therefore been introduced. Other major changes to this category include the use of the Haldex Lean Daily Management System (LDMS) from start, as this is a simple, yet powerful forum for teams to be informed and discuss progress. Finally, leadership support is added with criteria ensuring that team progression is followed by top management.

#### **Visualization**

“Visualization” is a consolidation of the current categories “Communication” and “Visualization”. Major changes concern introducing safety standards from the Copper level, strengthening the employee ownership of communication boards and better use of consensus definitions.

#### **Standardization**

“Standardization” is a category that remains fairly unchanged. However, one major change concerns strengthening people management by identifying and addressing competence gaps and systematic work with securing core competencies.

### **Takt & Balanced flow**

Current “Takt”, “Balanced flow” and “Takt & Balanced flow” are now found in the “Takt & Balanced flow” category. The concept is introduced already in the Copper level instead of Bronze. Improved support for implementation and leadership is added by introducing the use of implementation plans with a link to the overall strategic plan.

### **Consumption control**

The name “Consumption control” was used for this category instead of the current “Consumption control – Pull”, the reason being that this new category is fuller and more generic, holding criteria previously found in “Quality” and “Product development”. The work with consumption control is now introduced already in Copper instead of Bronze. Support for supply chain management is added with better usage of the Haldex Supplier Handbook and the Supply Chain Improvement Program (SCIP). Better use of implementation plans is also requested.

### **5S**

The 5S category was one of the more complete and well-designed categories in the current model, consequently not too many changes have been made. Some changes in the 5S category include using all 5S’s from start and including stronger support for standards, i.e. a standard ambition level is set at an early stage and that the Haldex 5S standard is used.

### **TPM**

The wide and generic concept of Total Productive Maintenance has been consolidated into the category “TPM”. Criteria concerning TPM were found mainly in the current categories of “Preventative maintenance”, “TPM – OEE”, “TPM”, “OEE” and “Process stability”. TPM is introduced from start with stronger support and should be implemented according to the Haldex TPM standard.

### **Mapping**

The “Mapping” category is a consolidation of the previous “VSM”, “Process mapping & VSM” and “Full value streams”. The label “Mapping” is preferred as the new category is more generic and include capturing the voice of the customer and control/contingency plans. Support for use of the Haldex standard mapping templates is strengthened.

### **Set-up & Change-over**

In the “Set-up & Change-over” category the concept of set-up and change-over time reduction is now introduced already in the Copper level. Further, increased focus on the use of OEE data for analyzing when and where to use the SMED methodology is added.

### **Error-proofing**

The category “Error-proofing” is based on the current “Poka Yoke” category. The name “Error-proofing” is used as this new category is fuller and more generic and it also include, in addition to Poka yoke-devices, contingency plans, corrective actions to customer concerns, etc. “Error-proofing” is also introduced from the Copper level to allow sufficient implementation time, and better use of implementation plans is included.

### **6 Sigma**

In the improved Tier model, 6 Sigma is introduced in Copper instead of in Silver. For the first two levels, focus is on creating support and understanding in the management team. Results

are requested in Bronze to ensure progression and providing a platform for the step to the relatively high level of 6 Sigma implementation requested in Silver.

### **Discussing the new horizontal structure**

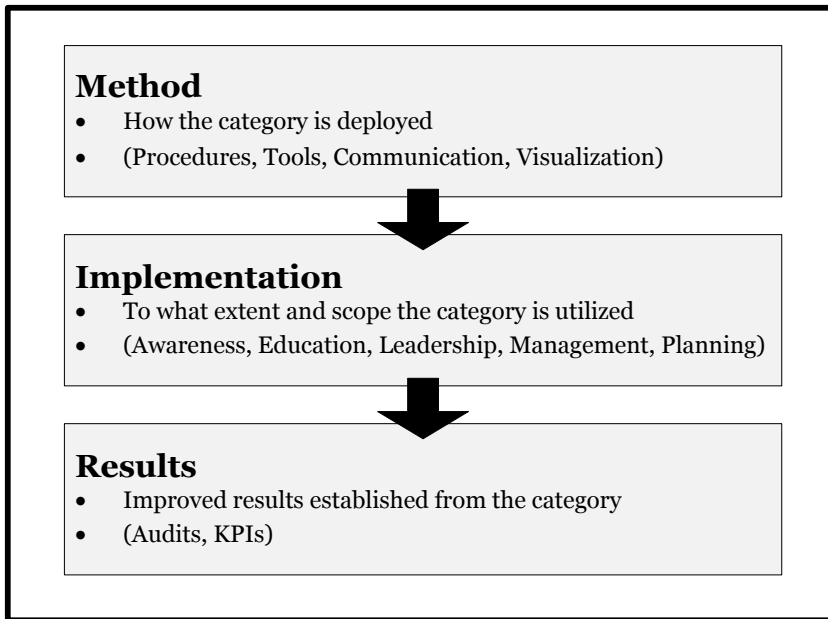
In the improved Tier model there will be fewer categories and they are now sorted in a reasonable order, starting with the goals that are to be obtained (the “KPIs” category) followed by the founding values and principles that should permeate the way all work is conducted, and finally the set of tools that should be used in reaching these goals.

With coherence in naming of categories and the fact that all categories range over all levels will enable a site to follow their progression in the tools and principles of Haldex Way in a more accessible manner.

### **6.3 Add a vertical structure to ease implementation, speed of progression and development of each category**

A vertical structure, based on the supportive structure found in the Gold Tier Enterprise Management System (GTEMS), has been added to the improved Tier model. This structure is not explicitly visualized in the challenge documents but rather act as an underlying support. This support will facilitate implementation, increase speed of progression and development in each category by providing a natural structure for what to do, how to do it and what results to expect. Further, the adding of a vertical structure for the criteria will add support for use of GTEMS and a Business Excellence model.

The underlying structure is based on three phases of progress; Method, Implementation, and Result. The choice of using the GTEMS structure was highly intentional as it is a structure well known to the organization and highly suitable for structuring the criteria. The main reason for not using an explicitly visible structure lies in creating buy-in for the model, looking at the matrix in Figure 5.5., the lower level’s focus is mainly on method and implementation (although results will follow naturally). With an explicitly visible structure, this focus would become clear and this would risk obstructing buy-in for low-level sites, as managers are prone to focus on results. Another reason is the complex nature of some criteria that will cover several phases of progress. The vertical structure is illustrated in Figure 6.1.



**Figure 6.1. The vertical structure.**

#### **6.4 Allow the Tier model’s criteria to be more flexible in the later levels**

Haldex has a wide variety of sites, some with functions ranging from product development to machining, assembly and sales, others acting as pure distribution centers or administrative units. With a model with a strong production focus, such as the Haldex Way Tier model, it is difficult to make it equally applicable for all sites. What can be done is allowing the model to be generic enough to make it work for all production sites, regardless of cycle-times, set-up times, number of employees, etc.

A better generic/specific balance and thus an improved functionality throughout the business has been obtained through several changes, such as the improved horizontal structure, but also by adding flexibility in the later levels for some of the more specific categories.

Just using a tool for the sake of the Tier challenge, as could be the case for e.g. SMED today (see Section 5.2.) we consider being waste. Instead, in the improved Tier model, OEE data shall be analyzed to see where and when the SMED methodology should be used to improve set-up and change-over times.

Another example is the current 6 Sigma category where very specific criteria regarding number of trained Black Belts and monetary benefits is found, see Section 5.2. We have maintained the high level of 6 Sigma performance, ensuring immediate Black Belt competency and great benefits but allowing sites to decide their Black Belts form of employment. Instead focus lies on ensuring that project goals are quantified and that the accumulated monetary benefits are tracked.

These changes in definitions will reduce the risk of tools being used for the sake of the challenge and by doing so creating waste. Adding flexibility for the later levels will be in line with the thoughts and concepts of the Business Excellence models, being more generic in nature.

## **6.5 Introduce consensus definitions and enhance support for existing standards**

A lot of work has been put into ensuring the use of consensus definitions in criteria and naming of categories throughout the Tier levels. In the new category “Visualization”, by consistently referring to “visualized” and “visualization” instead of the current terms “posted”, “communicated”, “displayed” inter alia, ambiguity and misinterpretations are eliminated. Similar changes have been made in the category “Teamwork”, where the terms “teams” and “teamwork” is used in favor of the currently used “cross-functional teams”, “cell-teams” and “continuous improvement teams”.

Poka Yoke devices can be very expensive to implement and it can be considered to be waste to implement such a solution in some cases. The now used “Error-proofing” is a more generic term, used to describe a process, procedure or device to ensure the prevention of error. This term is already well-known in the organization.

Increased support for the Haldex Way standards is added throughout the model. Stronger support for standards is found in the later levels of the Tier, but for a site to develop their own standards in the lower levels, when good standards are readily available that will provide a common language and best practices we consider to be waste. Increased support for standards such as Haldex floor marking standard, introductory programs and the LDMS has been added.

With the introduction of appropriate consensus definitions and a better support and referral to standards the need for clarifications of criteria, found mainly in the Silver level, is also eliminated and has consequently been removed.

## **6.6 Introduce necessary tools and methods at an appropriate level**

Many tools and methods take time to implement and results cannot always be expected from one day to another. In the improved Tier model all categories will be introduced from the Copper level, and hence all tools, principles and methods will also be introduced from start. In this way there will be sufficient time to build and create support, understanding and competence for all tools and methods, even those as complex as e.g. 6 Sigma.

The level of complexity of a tool or method should also influence when it ought to be introduced. We have for example introduced Process mapping prior to Value Stream Mapping in the improved Tier model instead of the other way around, as Process mapping is considered as an easier tool to get started with.

As certain tools and methods are a prerequisite for others it is also important to introduce them in the right order. PSP (Process Stability Projects) will hence be introduced from Copper instead of Gold in the improved Tier model, this to act as support for a successful TPM introduction. PSP is also a part of the requested Haldex TPM standard.

Other major changes involve introducing all 5S’s from start, this to make sure that the work with 5S gets systemized from start and that there will not be a drop in performance, see Figures 5.1. and 5.2. In order to not make this tool too complex and time consuming we have chosen to request implementation in pilot areas to start with.

## **6.7 Strengthen the visibility and support for the core values and principles**

With fewer categories the remaining ones will become more evident. The core values and principles will consequently be highlighted and their importance will be strengthened. This will hopefully build a more solid foundation and understanding for the tools and methods implemented.

Introducing an employee survey and ensuring that the results from this survey are used wisely to improve the business and the work environment will further strengthen the core value 'Respect for the individual'. People will have a structured and reoccurring forum to speak their mind regarding their working situation, what can be improved and how their managers are acting to improve their situation. The Haldex Employee Engagement Survey (HEES) will be used (allowing local adjustments), which is a powerful and useful survey covering the performance culture, people development and business orientation of the site. Further, an index can be extracted from the survey concerning the perception of leadership/management which can be proved to be extremely useful for leadership development.

Capturing the Voice of the Customer from an early stage and making sure that their input is evaluated and used, in for example product development initiatives, will further strengthen 'Customer first' core value.

We would like to emphasize that the work with analyzing and redesigning the Tier model itself with extensive interviews etc. have shed the light over the Tier model and its underlying core values and principles. Employees have had the chance to reflect over the model, its reason for existence, and how it can help them in their daily work, something that has not been done since it got created some 8-10 years ago.

## **6.8 Enhance support for administration areas**

What we have done to strengthen the support for administration areas involves explicitly asking for evidence in administration areas for applicable tools and methods. Also, with the new and more generic structure, all categories will be applicable for all areas of the business (with a possible exception of the Set-up and Change-over category), enhancing usability for administration areas tremendously. To support the sites with only administration functions we advocate keeping the current system with exception reports for KPIs.

## **6.9 Increase support for leadership/management**

Increased support for leadership/management is evident in the form of extended use of implementation plans, stronger links to the overall strategy, better follow-up of team progression etc. Where applicable, tools are introduced with a top-down approach, where it is important to first achieve an understanding of the tool at a management level, before plans for implementation can be created to finally implement the tools throughout the site.

The underlying vertical structure (Method, Implementation, Result) will also act as support for management when implementing different tools and methods. With this structure it will be easier to get an overview of what needs to be taken care of to succeed with a certain category.

Another way to support management is the introduction of the Haldex Employee Engagement Survey (HEES), here employees will have a chance to comment on management performance and managers can then use this feedback (the HEES leadership index) as a way to improve their performance.

### **6.10 Relocate the Product development and Quality categories to run through the remaining more generic categories**

In order to make the Tier model more generic, especially the later levels, we have split and relocated the Product development and Quality categories into the new, more generic categories. For the Quality category almost every criteria were possible to relocate in a natural way into the new categories. These criteria can depending on its content and formulation now be found in e.g. 'Error-proofing', 'Consumption control', and 'Mapping'. Product development is a very specific category, with criteria in detail describing how Haldex Way translates to R&D. This category has therefore been harder to relocate. Criteria can depending on its content and formulation now be found in e.g. 'Teamwork' and 'Standardization'. A rare few criteria, with very specific content, has been excluded but will all be covered in GTEMS.

### **6.11 Improve support for supply chain management**

To strengthen the support for supply chain management, improvements have been made in several categories. As Haldex already has a well-developed supplier handbook and supply chain improvement program (SCIP), enhanced support for these are now found in, for example; 'Consumption Control'. Support comes in the form of making sure that agreements with suppliers and customers are in line with the supplier handbook, and that there exists a supplier rating system which is in line with SCIP. Furthermore, every site should actively work with securing time to market and improving their cost structure and product flexibility in accordance with SCIP.

The voice of the customer (VOC) and voice of the business (VOB) should be captured from an early stage to ensure that these aspects are taken into consideration when improving quality, cost, and delivery. These aspects are highlighted in 'Mapping'. VOC does not only help improve supply chain management, it also acts as support for Business Excellence models.

### **6.12 Improve overall layout**

As mentioned earlier, all categories now stretch from Copper to Gold and this together with the implemented underlying vertical structure will greatly improve the overall layout. Furthermore we have made sure that there is no need for clarifications for any criteria, and all criteria are now formulated in a similar way.

The existing Gold Tier challenge documentation has been used as a template for all other Tier level challenges and this will ensure a similar layout for the challenge documents.

### 6.13 Final conclusion

The purpose of the thesis was to conduct a full analysis of the current Tier model, using a holistic approach, covering the structure of the model, the functionality for different parts of the business and the coherence of scope and requirements for the Tier levels. Through the analysis, all these areas have been covered.

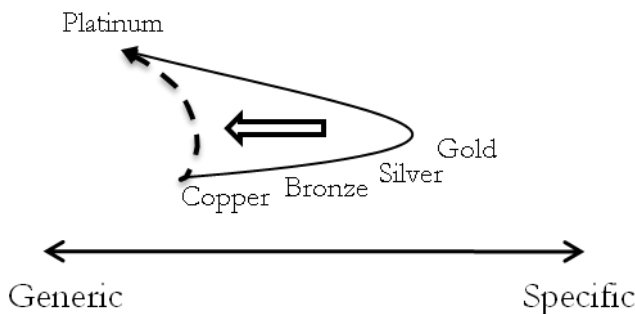
The structure has been thoroughly analyzed concerning both progression of categories, what has been referred to as the horizontal structure, and the structure of criteria, the vertical structure. Functionality for different parts of the business has been analyzed from a generic/specific perspective. Regarding the coherence of scope and requirements an analysis covering in what order tools and methods should be introduced, the prescriptive/non-prescriptive split, what should be required at each level and a benchmark against the Volvo Production System has been conducted.

Looking at the objectives for the thesis, a set of goals were set; the analysis should identify improvements that should be implemented in the improved Tier model regarding coherence of scope and requirements for the first four levels, support for a Business Excellence model being added and functionality for different parts of the business.

Improving the coherence of scope and requirements for the first four Tier levels and thus creating better guidance for site progression and utilization of lean tools and methods has been accomplished by introducing a set of new, more generic categories, all which are introduced from the Copper level and range all the way to Gold. Further, aligning criteria according to the developed matrix, see Figure 5.5., and ensuring that tools and methods are introduced in an appropriate order will facilitate progression and create buy-in for the model.

Providing support for a Business Excellence model being added has been achieved by a series of improvements, the main being the improved horizontal and vertical structure. Also, better leadership support with clear links to the overall strategy and strengthened supply chain management will add support.

Increased functionality for different parts of the business has been achieved through the new, more generic categories in the improved Tier model. Also, added flexibility for specific criteria and increased support for administration areas is included. The major changes throughout the redesigning process will have driven the generic/specific curve illustrated in Figure 4.3. to a more naturally progressing curve, illustrated in Figure 6.2.



**Figure 6.2. Generic/specific split of the improved Tier model.**

## 7 Discussion and future work

*In this final chapter, discussions and reflections regarding choice of methodology is presented together with actions for implementation. Finally, our recommendations for future work are presented.*

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### 7.1 Discussion

Working according to the described methodology makes us confident that the presented results can be considered both useful and trustworthy. Although, we are aware that using a Systems approach and having a qualitative research style makes the results somewhat subjective. It is however of our belief that an overall management tool such as the Haldex Way Tier model cannot be completely quantitatively and objectively analyzed and that the choice of methodology was correct. In the end, what truly makes an organization excel lies in the subjective view and knowledge of the employees.

We are also confident that not only the improved Tier model will be found helpful, but also the analysis and identified future work. The methodology used for the review will also facilitate future reviews.

In hindsight, conducting our benchmarking study against the Volvo Production System in an earlier stage might have provided more input for changes. Instead we had the opportunity to test our improvements against an prominent existing system and since our changes were in line with what was found in the benchmarking study, we do not feel there is a need to further speculate about what could have been.

Our recommendation for the sites on adopting the improved Tier model is simple: Recertify for your current level in accordance with the improved Tier model to get on track and then continue the effort to reach the next level. Changes are straightforward and as the new structure is uncomplicated, implementation should be as well.

### 7.2 Recommendations for future work

Throughout our work with the Haldex Way Tier model we have also encountered some improvement ideas that lie outside of our scope, but are still too important to be left out of this report. Below, these ideas will be presented, and we hope that bringing them to light will urge someone to take action against each and every issue.

#### **Highlighting the importance of process stability**

The importance of process stability cannot be highlighted enough, and as mentioned earlier (Section 5.5), in the current Tier model focus on process stability is first truly evident in the Gold level. Process stability is a prerequisite for most other improvement activities, without a stable process countermeasures and improvement actions are not sure to take the right direction. The lack of process stability focus was also evident in the benchmark against the Volvo Production System, a newer and perhaps a bit more mature system, where process stability is one of the founding principles. We first wanted to introduce a process stability category of its own, but felt that due to the lack of good training material and documentation it would rather hold back than facilitate progression. Instead we ask that better supporting material be developed prior to better support for process stability is introduced in the model.

### **Standards**

Since one of our goals involves “introducing consensus definitions and enhancing support for existing standards” it is important that the quality of the existing standards is high. We would like to see standards that are generic enough to be used across all Tier levels and across all functions. It is of our belief that where this is not possible the existing standards should be changed rather than criteria in the Tier model. The current standards are good, but could be improved further. They are fairly difficult to find and it is not always clear what document constitutes the standard.

### **Environmental work**

Looking at the Haldex Way house, see Figure 3.10., representing the very foundation of Haldex Way one will notice that the top priority is the environment. But looking at the current Tier model the only criterion one will find is a tick box on the front-page dashboard regarding if the site is certified according to ISO 14000. Simply, it does not add up. Environmental work, “Green production systems”, are highly compatible with “Lean production systems”. Generally they share the same goal of eliminating waste, only the toolbox differs slightly. With a well-working environmental system one could find improvements gaining the performance of the Lean system that would not have been found with the regular Lean toolbox. In parallel to this thesis, a project called just “Green production system” has been running, with the objective to improve the environmental work and performance of Haldex. An environmental category has been developed in that project. This category will be published in the improved Tier model as a “beta”-version, for the sites to get an idea of what to come. The maturity in the organization regarding environmental work is still low and there is a lack of sufficient training material and supporting documentation. Requesting sites to be challenged on this environmental category from start, before the maturity level of support is high enough, would risk obstructing progression in the Tier model for most sites. A high-performing environmental work would also be needed in order to build support for a Business Excellence model being added, where sites is requested to show how they take responsibility for a sustainable future. In today’s environmentally focused society, it is also expected that larger corporations build an environmentally friendly profile in order to be marketable. Finally, an environmental category can be added without making the Tier model more specific again as environmental work can, and should, cover all parts of the business.

### **Product development**

A consequence of the strong production focus of the current Tier model is that it is rather reactive than proactive. Improvement activities and actions are taken against correcting and improving process flaws to a greater extent than product design flaws. In future revisions of the Tier we would like to see an even stronger focus on finding root-causes to issues instead of correcting their consequences in the production process. We feel that the product development category in the current site Tier model did not achieve this satisfactory and that many of the criteria is better suited for the GTEMS model.

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# Appendices

## Appendix A, dashboard of the current Gold Tier Challenge document

