Royal Grolsch

Assessing competences needed in technical and maintenance functions at Grolsch

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In November 2012, I started my graduation project at Royal Grolsch in Enschede. This master thesis focuses on the assessment of functional and cognitive competences needed in technical and maintenance functions at Grolsch. This research became a learning experience in which I have seen many sides of a big company. The contact with other employees of Grolsch was very pleasantly which allowed me to carry out my research well. This research was not possible without the employees of Grolsch and the supervisors of the University of Twente.

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Jordy Tijman op Smeijers

Summary

While there has been a lot of research on the importance of managing competences in a company, little is known at Grolsch about defining competences in a concrete way that makes specific development of needed competences possible. Grolsch wants to use competence guidelines and assessment criteria for the assessment of the technical teams and the maintenance teams. The purpose of this research is to elaborate the needed competences and assessment criteria for technical and maintenance functions in a structured way. The research question resulting from this is:

Which competences do technical and maintenance functions need at Grolsch, and which requirements of output for proving to be competent are associated to these needed competences?

With answering this research question, recommendations are made about how to assess the needed competences.

Based on the theory in chapter 2 it became clear that the focus is on cognitive competences (i.e. knowledge) and functional competences (i.e. skills). There should be an assessment to determine whether or not an employee possesses a functional or cognitive competence. There are different ways conceivable in which information can be collected with the aim of ruling on whether a person is competent. The evaluation methods described by Maes and Sels (1999) are useful for this research; these methods resulting in hard proof whether an employee possess a functional or cognitive competence.

Document analysis and interviews are used to develop a competence model for technical and maintenance functions. The document analysis consists of analysis of the job descriptions and has resulted in a first draft of the competence model. Based on the interviews with important stakeholders changes are made and with this the competence models for technical and maintenance functions are finalized. A focus group is used to find out which requirements of output for proving to be competent are associated to the functional and cognitive competences. The same respondents are used for the focus group as for the interviews. The data generated from the document analysis, the interviews, and from the focus group resulted in overviews of needed competences and associated requirement of output. The overview for technical functions is presented in Table 8 in the sub-paragraph 4.1.2.1. The overview for maintenance functions is presented in Table 9 in the sub-paragraph 4.1.2.2.

Based on the developed competence models, the requirements of output for proving to be competent, and Bloom et al.'s taxonomy (1956) the evaluation of Maes and Sels (1999) are linked to the competences. There are six methods useable for the evaluation of functional and cognitive competences at Grolsch. These six methods can be divided in two groups:

- Evaluating competences in line with level 1 of Bloom's: open questions, multiple choice situation analysis;
- Evaluating competences in line with level 2 of Bloom's: practical test, case study, various-points-in-time-assessment, scenario analysis.

This means for Grolsch, when it is about evaluating cognitive competences the open questions method and the multiple choice situation analysis are useful methods. The advantages and

disadvantages of these methods will decide which one is the most useful for evaluating a specific competence. When it is about evaluating functional competences there are four methods useful. The most useful method is the practical test; this method is closest to reality. Using this method is not always feasible and for some competences it does not provide the desired result. Then, a case study or scenario analysis may be useful because these methods can be influenced by Grolsch (e.g. changing parameters to evaluate identifying skills). A various-points-in-time-assessment is most useful when evaluating competences that are hard to measure. This method can evaluate knowledge and skills, but a disadvantage is that results are subjective.

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1. Introduction

1.1 Introduction to the topic

Many companies nowadays face an increasing global competition. Due to this it is argued that knowledge and skills are the key sources of competitive advantage (Gubbins & Garavan, 2009). These knowledge and skills or human resources are manageable (manoeuvrable) and developmental. In other words, HR practices can (a) increase the value of the human capital pool through development (e.g., skills training, general training, job rotation, coaching) and (b) influence employee behaviour in the desired direction (Paauwe & Boselie, 2005). At the time when business is good, firms easily justify the expenditures on training, staffing, reward, and employee involvement systems. But when they are faced with financial difficulties, such HR systems fall prey to the earliest cutbacks (Wright, Dunford & Snell, 2001). Partly due to the increasing global competition organizations face rapid changes. This ensures that it is clear that employees must continue the learning process throughout their careers in order to meet these challenges. The need for lifelong learning will require organizations to make an on-going investment in human resource development (HRD) (Werner & DeSimone, 2011). This places the HRD function in a situation of increased status and power, if HRD professionals adopt roles in a way that adds "value" and facilitates achievement of competitive advantage.

1.2 Problem definition

The increasing global competition and the rapid changes that organizations faces are also experienced at Grolsch, a subsidiary of SABMiller (see Appendix A). Grolsch decided in 2010 to implement the so-called World Class Manufacturing (WCM) way of working. Reason for this was to cope with the increasing global competition and the rapid changes the organization faces. On January 1, 2011, the company started with the implementation of WCM in practice. Companies engaged in WCM practices focus on improving operations, elimination of waste and creating lean organizations that often leads to higher productivity (Haleem, Sushil, Qadri & Kumar, 2012). It is a set of tools that will help employees to improve their performance, and therefore will also improve how the company is seen – by themselves and by others. These tools enable the company to compete effectively – both internally in SABMiller (e.g. for volume and key performance indicators) and externally in the marketplace (e.g. for quality and sales). WCM allows and drives continuous improvement, even as this improvement becomes harder to find over time. The purpose of the implementation of WCM is to become the best in the field of production of beer. Grolsch wants to achieve a stabilization of the production process, optimizing cooperation in teams, improve technical skills and capacities, increase flexibility in order to implement changes as quickly and efficiently as possible, and change their mind set to look further ahead (Grolsch, 2010).

In order to reach these targets employees should be assessed on needed knowledge and skills. This assessment of employees is done using so-called competence guidelines and assessment criteria. A problem in management research is how to define and conceptualize competences in work practice. The concept of competence is systematically used as a basic general notion to address the relation between person and work when explaining performance (Ripamonti & Scaratti, 2011). Job analysis and competence modelling are typically used to study the performance of target jobs. Results of these analyses identify the dimensions to be assessed and the content of assessment exercises (Thornton & Gibbons, 2009). But these analyses are often ending disappointing in a list of relevant

competences which are no more than general, abstract formulations with any hard meaning, e.g. give constructive feedback, monitoring the performance of a unit, act as a coach. Even if such competences are based on careful research, they often stab at a general level. This makes them widely applicable, but also makes them little useful in answering the question: how can you provide proof that you have acquired the relevant competences (Kessels, 1999)?

1.3 Objective and research question

While there has been a lot of research on the importance of managing competences in a company, little is known at Grolsch about defining competences in a concrete way that makes specific development of needed competences possible. Grolsch has already established the competence guidelines and assessment criteria for the assessment of competences of the executive functions. This provides an insight in the needed competences of these employees. The company also wants to use competence guidelines and assessment criteria for the assessment of the technical teams and the maintenance teams (the specific functions are attached in Appendix B).

The purpose of this research is to elaborate the needed competences and assessment criteria for technical and maintenance functions in a structured way. The research question resulting from this is:

Which competences do technical and maintenance functions need at Grolsch, and which requirements of output for proving to be competent are associated to these needed competences?

With answering this research question a contribution can be made in determining the needed competences for technical and maintenance functions at Grolsch. At the end, the purpose is to give recommendations about how to assess the needed competences, based on the requirements of output for proving to be competent.

1.4 Research design

First, a literature study is presented in chapter two. The underlying theories are clarified, and with this how functions can make a contribution to the achievement of strategic purposes of an organization. The concept of competences is elaborated, including the types of competences distinguished in literature and the types of competences which are relevant for this research. After this, assessment methods that are suitable when assessing competences are discussed. Chapter two ends with a conceptual model that is used in this research. The methodology of the research is outlined in chapter three. Document analysis and in-depth interviews with experts take place to develop the competence models. A focus group is used to figure out what the requirements of output are for proving to be competent. This data is necessary to give an advice about how to assess the needed competences. The results are elaborated in chapter four. In chapter five are the conclusions discussed with reference to the used literature, the methodology, and the results. In addition, recommendations are made towards future research and towards Grolsch.

2. Theoretical framework

In this chapter the theoretical background of the research will be discussed. First, the underlying theories of this research will be clarified. After this, the concept of competence and the different elements of competences are made clear. This is followed by theory about how to assess competences.

2.1 The resource-based view and human capital as the underlying perspectives

In this section, the underlying perspectives of this research are clarified. This means a clarification of the resource based view (RBV) and the human capital theory. These are the underlying theories that clarify the relation between employees and the achievement of strategic purposes of organisations.

2.1.1 The RBV as underlying perspective

There has been a growing acceptance of internal resources as sources of competitive advantage and this brought legitimacy to HR's assertion that people are strategically important to firm success (Wright et al., 2001). The RBV of the firm is concerned with the relationships between internal resources (of which human resource is one), strategy and firm performance. It focuses on the promotion of sustained competitive advantage through the development of human capital rather than merely aligning human resources to current strategic goals (Torrington, Hall & Taylor, 2008). Of course, not all firm resources hold the potential of sustained competitive advantages. To have this potential, a firm resource must have four attributes: (a) It must be valuable, in the sense that it exploit opportunities and/or neutralizes threats in a firm's environment, (b) it must be rare among a firm's current and potential competition, (c) it must be imperfectly imitable, and (d) there cannot be strategically equivalent substitutes for this resource that are valuable but neither rare or imperfectly imitable. These attributes of firm resources can be thought of as empirical indicators of how heterogeneous and immobile a firm's resources are and thus how useful these resources are for generating sustained competitive advantage (Barney, 1991). Human resources are also resources that can provide a sustained competitive advantage for the business, as long as they are unique and cannot be copied or substituted by competing organisations (Torrington et al., 2008).

2.1.2 The Human Capital theory as underlying perspective

The RBV has helped to build a productive theoretical bridge between the field of strategy and HRM (Wright et al., 2001) resulting in strategic human resource management (SHRM). SHRM is predicated on two fundamental assertions. The first assertion is the idea that an organization's human resources are of critical strategic importance – that the skills, behaviours, and interactions of employees have the potential to provide both the foundation for strategy formulation and the means for strategy implementation. The second assertion is the belief that a firm's HRM practices are instrumental in developing the strategic capability of its pool of human resources (Colbert, 2004). As different groups of employees possess skills that vary in importance to a firm's competitiveness, the HR practices used to manage them also vary (Jackson, Schuler & Rivero, 1989; Lepak & Snell, 2002). It is argued that the most appropriate mode of investment in human capital will vary for the different types of human capital (Lepak & Snell, 1999). Lepak & Snell (1999, 2002) focuses in their study on the strategic value and uniqueness of human capital as principle drivers of employment modes (internal development, acquisition, contracting, or alliances) and HR configurations (commitment, market based, compliance, or collaborative). They refer to the potential to improve the efficiency and effectiveness of the firm, exploit market opportunities, and/or neutralize potential threats when discussing the *strategic value* of human capital. On the other hand, they refer to the degree to which the human

capital is rare, specialized and, in the extreme, firm specific as mentioned in the RBV when discussing the *uniqueness* of it (Lepak & Snell, 2002). Lepak & Snell (2002) juxtaposed these two dimensions, and derived a model of the relationships between human capital characteristics and employment modes (see Figure 1).

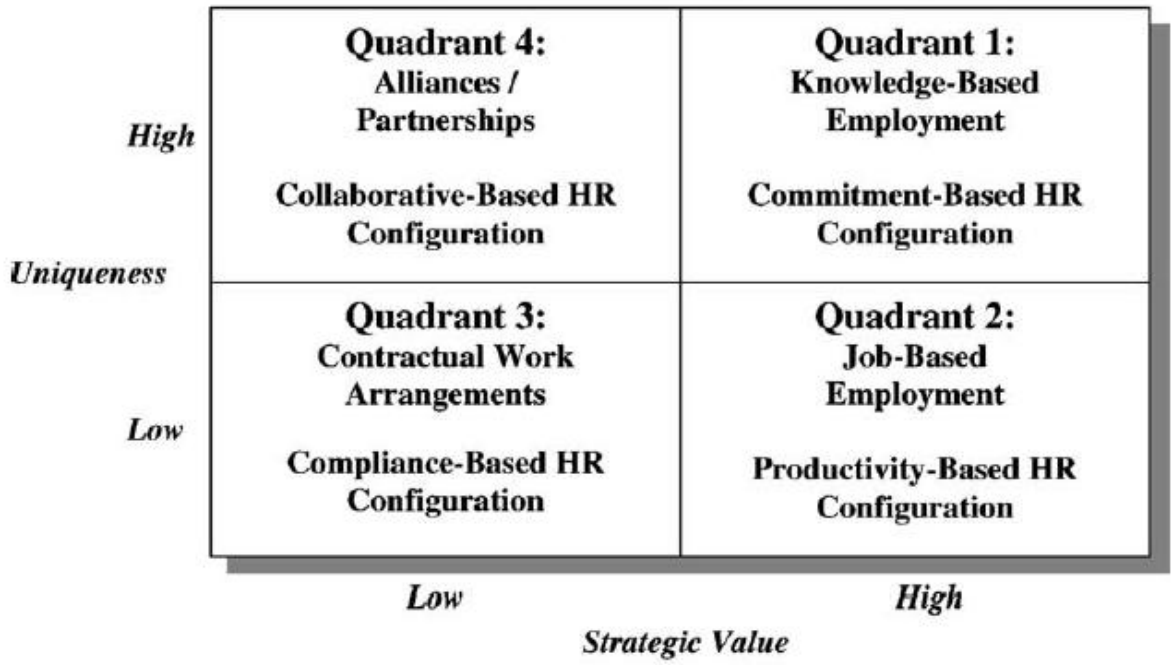

Figure 1: Human Capital Characteristics and Employment Modes (Lepak & Snell, 2002, p. 520)

When the human capital is both valuable and unique, it represents the knowledge base around which firms are most likely to build their strategies. These workers are those most likely to represent a firm's knowledge workers. Lepak & Snell (2002) define these people, based on Horibe (1999), as "people who use their heads more than their hands to produce value" (Lepak & Snell, 2002, p. 520). Human capital that has strategic value but limited uniqueness falls within the bottom right quadrant; job-based employment. These worker's skills are not particularly unique to a firm and thus, cannot serve a differentiating source of competiveness. Workers within this quadrant are able to make significant contributions to a firm while possessing skills that are widely transferable. Quadrant three contains human capital that is neither of particularly high strategic value to a firm nor unique. The workers in this category are prime candidates for outsourcing. And in the last quadrant, firms will rely on alliances/partnerships for human capital that is unique but of insufficient strategic value to employ internally (Lepak & Snell, 2002). Lepak & Snell (2002) asked in their research respondents to allocate the jobs their firm employed in the employment mode. The interesting outcome was that the same jobs were allocated in different quadrants. Lepak & Snell (2002) concluded that firms allocate jobs in different ways and so are of different strategic value and uniqueness to firms.

2.1.3 The relationship with competence management

Competence management has been suggested as a way to more effectively utilise human capital, as discusses previously, in the workplace (Ley & Albert, 2003). The concept of competence management is well recognized as extremely important for realising the ambitions of a company (De la Parra, Slotman, Tillema & Spannenburg, 2000) and the achievement of company goals, complementary to, for instance, core business processes, customer relationships, and financial issues (Berio & Harzallah,

2007). Competence management has the prime objective to well define and continuously maintain the set of competencies[1] according to objectives of the corporation. It is part of all three company's control level, i.e., strategic, tactical, and operational. It impacts the strategic level because it ensured that the competencies required for achieving the strategic objectives are correctly identified (Harzallah, Berio & Vernadat, 2006). These competencies refer to strategic distinctive core competencies; the strategic ability to sustain the coordinated deployment of strategic assets in a way that helps the organisation to achieve its strategic goals (Van Assen, 2000; Cramer & Van der Zwaal, 2006). It also impacts the tactical level because managers need to guarantee the achievement of the tasks for which they are responsible by reorganizing the work, reallocating the personnel, recruiting new members, or deciding on the persons to be trained (Harzallah et al., 2006). These competencies refer to organisational competencies; the specific way group capabilities are linked and related to functional capabilities (Van Assen, 2000; Cramer & Van der Zwaal, 2006). Finally, it impacts the operational level because it can be used for day-by-day personnel reallocation, for instance, to face some unexpected situations (e.g., missing staff) (Harzallah et al., 2006). These refer to individual competencies; attributes of individual capabilities (Cramer & Van der Zwaal, 2006; Van Assen, 2000). The three levels of competencies show overlap as can be seen in Figure 2. Individual and organisational competencies are needed to reach strategic goals of an organisation (Cramer & Van der Zwaal, 2006).

Figure 2: Three levels of competencies (Van Assen, 2000, p. 144)

Each of these control levels deal with strategies, projects, processes, tasks, and so on, which often have to meet specific targets of some associated key performance indicator (KPI) (Harzallah et al., 2006). According to Parmenter (2010), KPIs represent a set of measures focusing on performances that are most critical for the current and future success of the organization. KPIs help teams to align themselves with their organization's strategy.

2.1.4 The theory applied to Grolsch

The theory in this section demonstrates why attention is paid to the management of competences. In this research, it is about the needed individual competences for technical and maintenance functions. As mentioned by Cramer and Van der Zwaal (2006) these individual competences are needed to reach strategic purposes of the organisation. This implies for this research: stabilization of

[1] The terms competences and competences are used interchangeably in literature. The differences between the two terms are explained in section 2.2.

the production process, optimizing cooperation in teams, improve technical skills and capacities, increase flexibility in order to implement changes as quickly and efficiently as possible, and change mind sets of employees to look further ahead. Similar functions as the relevant functions in this research (technical and maintenance) were also taken into account in the survey of Lepak & Snell (2002). The result was that these jobs were allocated to the contractual work quadrant of their model (see Figure 1). In this research, the functions are allocated to the second quadrant of the model of Lepak & Snell (2002); job based employment. This is because, based on the definition of strategic value used by Lepak & Snell (2002), the relevant functions in this research do have strategic value. The employees in the technical and maintenance functions have the potential to improve the efficiency of the firm by making improvements in the efficiency of the production process. In addition, they have the potential to neutralize potential threats in the production process (e.g. preventing shutdowns). The employees with a technical function are the employees who are closely involved in the production of the end product, and with this are close to certain KPIs. The workers are able to make significant contributions to the firm purposes because they are closely involved in the development of core products. This ensures that they have strategic value for the firm. The uniqueness of the human capital of the mentioned functions is relatively low. Employees in the technical and maintenance functions are able to make significant contributions to Grolsch but they possess skills that are widely transferable. However, as people work for a longer period in the company, their knowledge becomes more firm-specific and with this the uniqueness of their human capital increases. This suggests that they become even more important for the company over the years. There are also two other functions included, the maintenance planner and the maintenance controller, that to a lower level are strategically valuable for the company but are still allocated in the second quadrant. These workers are not in direct contact with the production of the products, but are still closely involved in the production process.

2.2 Competences and competencies

So the RBV has changed the way in which organizations look at their resources, where industrial performance for a long time has been considered only as a result of technical resources optimization. During the recent decades, a competence based approach has emerged as a promising concept for taking into account human skills, knowledge, and abilities while addressing organizational goals and constraints (Houé, Grabot & Tchuente, 2011). While determining the organization's extant and desired core competencies is generally part of strategic management's macro focus, managing those competencies at an operational level is usually the responsibility of human resources management; at the level of the individual, i.e., the micro level (Lindgren, Henfridsson & Schultze, 2004). In this section the concept of competence versus competency will be clarified because there is confusion about the use of the two terms. They are often used interchangeably when there is a clear difference between competences and competencies.

2.2.1 Competence versus competency

As with many other terms in common use, 'competence' and 'competency' have a variety of meanings, and this variety of meaning is particularly pronounced as usage moves from the common to the specific (Moore, Cheng & Dainty, 2002). Some are intermixing the definitions of competence and competency (Teodorescu, 2006), but according to several articles there is a distinction between the two and it is not only about details (Korthagen, 2004). In the article of Moore et al. (2002) 'competence' is defined as what people need to be able to do to perform a job well; the emphasis is

on doing. They define 'competency' in terms referring to those dimensions of behaviour lying behind competent performance. Hoffmann (1999) state that the term 'competence' has been used to refer to the meaning of standards, while the term 'competency' has been used to refer to the meaning expressed as behaviours. Delamare Le Deist and Winterton (2005) refer to the United Kingdom approach and the American approach when discussing the terms. The term 'competence' is in line with the UK approach and focuses on the functional aspect. The term 'competency' is in line with the American approach and focuses on the behavioural aspect. Hoffmann (1999) expressed the difference between the two approaches also by input and output characteristics; the input-based approach and the output-based approach. The input-based approach (in line with the US approach) describes the underlying attributes, which lead to competent performance. The output-based approach (in line with the UK approach) describes specific performances and standards required. According to these approaches, complex jobs may best use an input-based approach because there is uncertainty about the required performances. Where jobs are more complex, the task of describing outputs is more difficult. This is due to the wider range of outputs deemed appropriate to demonstrate competent performance. Simpler jobs can benefit from an output-based approach because for these it is easier to describe the required performances (Cramer & van der Zwaal, 2009; Hoffman, 1999). Bouman (2012) summarized the two concepts as:

Competence:
"The functional scope or needed skills to perform satisfactory in a job with United Kingdom as origin country" (Bouman, 2012, p. 17).

Competency:
"The behavioural scope in order to become a high performer based on the origin of the United States" (Bouman, 2012, p. 17).

2.2.2 Elements of competences and competencies

Alongside the differences between the UK and the US approach, they also show similarities; competence and competency both include some characteristics like skills, knowledge, and attitude (Bouman, 2012). Garavan and McGuire (2001) point out that there is some agreement that competences and competencies can be divided in observable and more non-observable elements of competence. The structure of these elements is comparable to that of an iceberg (Korsten, 2002) and is shown in Figure 3. Other authors (i.e., Bouman, 2012; Cramer & Van der Zwaal, 2006; Rakickaite, Juceviciene & Vaitkiene, 2011) also refer to this model.

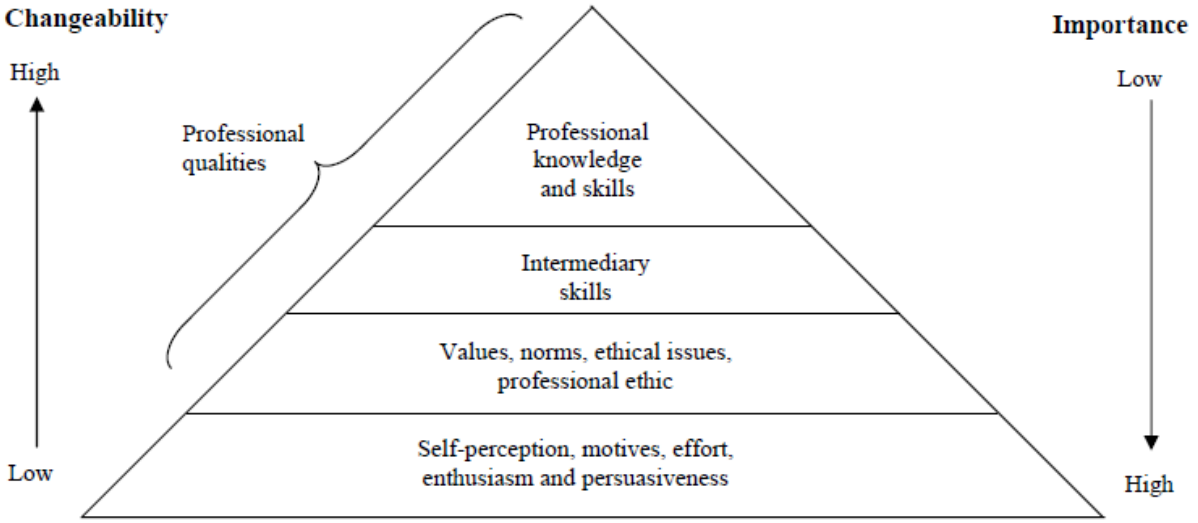

Figure 3: The elements of competences/competencies in an iceberg structure (Bergenhenegouwen, Mooijman & Tillema, 1999, p.77)

The top of the iceberg structure concerns the observable knowledge and technical skills relating to the exercise of the function, also called the instrumental skills. This knowledge and skills is learned in vocational and professional training and is documented in certificates and diplomas. For this there are special training programs and courses that can be followed during the professional practice (Bergenhenegouwen, Mooijman & Tillema, 1999; Spencer & Spencer, 1993). Below the top of the iceberg is the layer of the intermediate skills that are applicable in multiple occupations. This layer includes the social and communication skills, general technical skills, and organisational skills (Bergenhenegouwen et al., 1999; Hövels & Römkens, 1993). The intermediary skills are important with regard to flexibility and multi-employability of people. The instrumental skills and the intermediary skills together can be considered as the capability of the profession or function (Bergenhenegouwen et al., 1999). The third layer in the structure consists of the norms and values, ethical issues and the professional ethic of an organisation and of a group, where a person belongs to. These norms and values are internalized in a person based on their own insight, experiences and education. These first three layers can be characterised as the professional qualities of the person. At last, the bottom layer of the iceberg structure consists of deeper characteristics such as self-perception and motives (Bergenhenegouwen et al., 1999).

The first two layers are the most observable elements which are in line with the term competences. The last two layers are hard elements to observe, determine the behaviour of people, and so are in line with the term competencies. As can be seen in Figure 3; the more important an element is, the less changeable it is. Based on this, Cramer and Van der Zwaal (2006) conclude that the last two layers are harder to measure and to develop compared to the elements in the first two layers. This means that competencies are harder to measure and to develop than competences.

2.2.3 Purposes of competence and competency models

When clustering competences or competencies into models, the competence models or competency model occurred (Bouman, 2012). Because these models can be used for different goals, Cramer and Van der Zwaal (2006) mentioned that an organisation can start to develop such a model after the goal of the model is made explicit. A certain goal can change the impact of the selected

competences/competencies. Cramer and Van der Zwaal (2006) described three different goals of competence/competency models based on Rowe (1995):

- Recruitment: models to help the organization to identify suitable candidates at the recruitment stage. The purpose is to establish the 'behaviour traits' needed in a particular job and the extent to which different candidates possess these;
- Skill assessment: models to assess whether people are competent in their work. This exercise may be well linked to a qualification and the aim is to determine whether an employee is working to particular standards;
- Development: models to help existing staff to develop. The aim is to assess individual strengths and weaknesses so that future development can be identified.

It is argued that the rationale for the use of either competence models or competency models will determine the definition given to the term (Hoffmann, 1999). Rowe (1995) provides an overview of the main differences of the three goals based on perspective, model, and grading. The overall framework for the three different goals is presented in Table 1 (Rowe, 1995).

Table 1: A framework for three different goals

Stage	Perspective	Model	Grading
Recruitment	Future	Behaviours (Competencies) (How?)	Some grading
Skill assessment	Past/present	Competences (What?)	No grading
Development	Future	Capabilities (Competencies) (How?)	Grading

Adapted from "Clarifying the use of competence and competency models in recruitment, assessment and staff development", by C. Rowe, 1995, *Industrial and Commercial Training, 27(11),* p. 17. Copyright 1995 by the MCB University Press.

As can be seen in Table 1, the perspective of the recruitment and development goal is future oriented whereas skill assessment focuses on the past or the present (Cramer & Van der Zwaal, 2006; Rowe, 1995). The goals for recruitment and development are in line with the term 'competency' because they are more behaviour-oriented, where skill assessment is in line with the term 'competence'. 'Competence' is only measured on pass or fail basis; people are either competent or they are not yet competent. In the recruitment and development stages the focus is on looking for different things. 'Competent' means here "the minimal standard required", so in these stages there is a grading (Rowe, 1995). So as with the terminology of 'competence' and 'competency', the terms 'competence model' and 'competency model' also differ of meaning. With competence models the area of focus is the definition of measurable, specific, and objective milestones describing what people have to accomplish to consistently achieve or exceed the goals to their role, team, division, and whole organization (Teodorescu, 2006). In competency models the area of focus is the definition of skills, knowledge, attributes, and behaviours that successful people have (Teodorescu, 2006).

The differences between 'competence' and 'competency' according to the used literature are summarized in Table 2.

Table 2: Differences between competence and competency

Article	Competence	Competency
Moore et al. (2002)	What people need to be able to perform a job well	The behaviour(s) supporting an area of work
Delamare Le Deist and Winterton (2005)	UK approach: focus on functional aspect	US approach: focus on behavioural aspect
Hoffmann (1999); Cramer and Van der Zwaal (2006)	The meaning expressed as standards; Output-based approach; Used for simpler jobs	The meaning expressed as behaviours; Input-based approach; Used for complex jobs
Bergenhenegouwen et al. (1999)	Elements: professional skills and knowledge, intermediary skills.	Elements: values, norms, ethical issues, professional ethic, self-perception, motives, effort, enthusiasm, persuasiveness.
Rowe (1995); Cramer and Van der Zwaal (2006)	Goal: skill assessment	Goal: recruitment or development

2.2.4 The theory applied to Grolsch

Hoffmann (1999) argued that the rationale for the use of either competence models or competency models will determine the definition given to the term. In this research, the rationale is to assess whether employees are competent in their work. The aim is to determine whether an employee is working to particular standards required by Grolsch. This is in line with skill assessment and with this the focus is on 'competences'. The goal is to find out which competences are needed for technical and maintenance functions at Grolsch and to define these competences in a concrete way (a concrete assessment). The focus is on what people need to perform well in their job (UK approach), rather than the underlying behavioural aspect (US approach). So, despite the fact that the purpose of the implementation of the WCM way of working is to become the best in the field of production of beer and strive for 'operational excellence', the concept of *competence models* will be used. The focus in this research is on the actual needed competences. The starting point here is defining the requirements for a good job performance. This approach has the analysis of the function or a set of responsibilities as the focus area. From an identification of the activities to be conducted will be determined which output is expected, which standards are applicable to them and which demands are placed for knowledge and skills (Lap & Reijn, 1998). The fact that the focus is on knowledge and skills does not mean that competences in line with the intermediary skills are excluded completely.

2.3 Competence models

It is made clear that the focus is on competence models, but literature makes a distinction between different types of competence models. These models will be discussed in this section.

2.3.1 Framework of competence modelling

Markus, Cooper-Thomas and Allpress (2005) make a distinction between generic and specific competence models. Generic (or universal) competences are applicable across roles and organisations, whereas specific competences are those particular to roles and organisations (Markus et al., 2005). According to Cramer and Van der Zwaal (2006) the goal of a generic competence model can be development or recruitment of people, while a specific competence model can be used for skill assessment as well. A specific competence model is based on a generic competence model, but

it can be translated to specific situations of an organization. Therefore, the goal of a specific competence model can also be the assessment of skills.

Both Cramer and Van der Zwaal (2006) and Bouman (2012) refer to the holistic model of Delamare Le Deist and Winterton (2005) as an important competence model (see Figure 4).

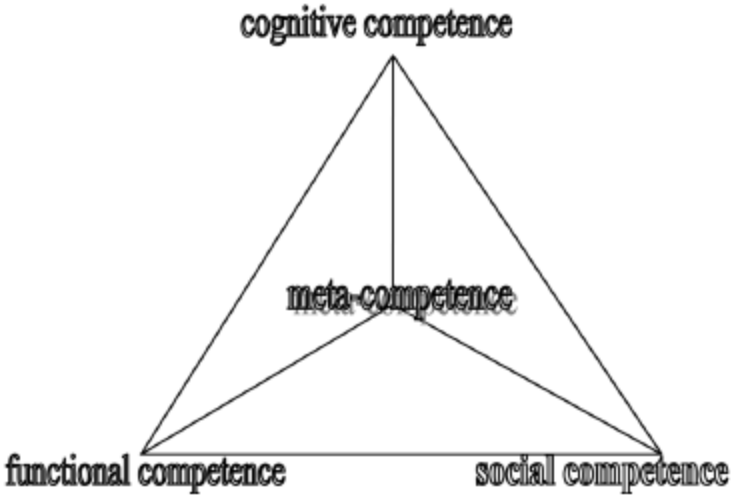

Figure 4: Holistic model of competence (Delamare Le Deist & Winterton, 2005, p. 40)

According to Delamare Le Deist and Winterton (2005) the holistic typology is useful in understanding the combination of knowledge, skills, and social competences that are necessary for particular functions. Based on Delamare Le Deist and Winterton (2005), we can conclude that:

- Knowledge (and understanding) is captured by cognitive competence;
- Skills are captured by functional competence;
- The attitude (and behaviour) is captured by social competence.

Cognitive competences refer to the knowledge (know-what), underpinned by understanding (know-why) of a person (Delamare Le Deist & Winterton, 2005). Functional competences refer to skills and the related know-how; those things that "a person who works in a given occupational area should be able to do and be able to demonstrate" (Delamare Le Deist & Winterton, 2005, p. 35). The social competences are described as the attitudes and behaviours to perform the profession (Bouman, 2012). Meta-competence is "concerned with the acquisition of the other substantive competences" (Delamare Le Deist & Winterton, 2005, p. 39) so it rather differs from the other three dimensions. It should be noted that the distinction between the dimensions can be made analytically. However, in practice it is difficult to separate the cognitive, functional and social dimensions in order to be effective at work. This is the reason why it is illustrated in Figure 3 as a tetrahedron; it reflects the unity of competences (Delamare Le Deist & Winterton, 2005).

2.3.2 The theory applied to Grolsch

Where generic competence models run the risk of being so broadly defined that they are not perceived by individuals as relevant, the specific competence models have the disadvantage of being too time-consuming. In contrast, as Bouman (2012) stated in her research, the holistic framework of Delamare Le Deist and Winterton (2005) provides an overall approach of competences including the consequently recurring knowledge, skills and attitudes. The model of Delamare Le Deist and

Winterton (2005) helps to identify the competences relevant in this research. The focus in this research is on the knowledge and skills of employees in Grolsch, this implies that the focus is on the actual needed cognitive and functional competences. These competences also refer to the knowledge and skills that are mentioned in the iceberg structure of competences of Bergenhenegouwen et al. (1999) in paragraph 2.2.2. The social competences and the meta-competences are not taken into account. The determination of all these competences at once would be too time-consuming. First, Grolsch wants to determine which functional and cognitive competences are needed to perform well in a function. Once that is known, the next step can be taken; determining the social and meta-competences for these functions.

2.4 Assessment of competences

The underlying theories and the relevant types of competences for this research are made clear. In this section, the assessment of competences will be discussed. The purpose is to clarify the concept of assessment and in which way assessment contributes to find out whether or not a person is competent.

2.4.1 Instruments for assessment

The area of skills and knowledge is the area where a lot can be done with targeted education and training (Van Wijk & Meijer, 1999). But as mentioned in the introduction chapter; results of analyses of the dimensions of competences to be assessed are often ending disappointing in a list of general, abstract formulations with any hard meaning. To find out how to assess needed competences, first the concept of assessment will be made clear:

“Assessment is the process of gathering and discussing information from sources in order to develop an understanding of what an individual knows, understands, and can do with his or her knowledge” (Hull, 2012, p.51).

This definition implies the purpose of assessment; developing and understanding of what an employee knows, understands, and can do with his or her knowledge. By means of an assessment, the employee can prove whether or not he or she is competent. When this is made clear, learning situations can be created where employees are given the opportunity to acquire the needed competences. The ultimate goal is that employees apply all the needed competences with enthusiasm in their work and so, eventually, work in line with the organizational standards and goals (Kessels, 1999).

There are many different ways conceivable in which information can be gathered with the aim of ruling on whether a person is competent. But there is only one aspect in which an assessment essentially differ from another and that is the setting in which the evidence for competence is gathered. This can be in a work situation or in a test situation (Straetmans & Sanders, 2001). The advantage of observation in real practice is the high degree of acceptance by both the assessor and the assessed person. Disadvantages of this method are the risk of wrong conclusions due to limited number of tasks performed and problematic scoring of ‘good’ behaviour in work practice. Besides this, observation in a work situation is rather time-consuming (Straetmans & Sanders, 2001). The focus of observation in real work situations is more related to the behaviour of a person. Information about competences can be demonstrated in a simulated work situation, which can be also very realistic. Assessment in test situations are more focused on the assessment of separate competences and elements of competences. Straetmans and Sanders (2001) distinguish three levels of

representativeness and linked instruments to it for the assessment of the competences. This is summarized in Table 3.

Table 3: Representativeness of competence assessment in test situation (Straetmans & Sanders, 2001)

Representativeness	Instrument	Strengths	Weaknesses
High	Work sample test: the assessed person should under circumstances, that approach a real work situation, perform tasks that are derived from the corresponding function.	- Realistic tasks in realistic setting; - Results are respected and accepted; - Many competences (e.g. cognitive, knowledge, perceptual and affective skills) are appealed.	- Problematic scoring; - Preparation is time-consuming; - Execution is time-consuming.
Average	Skill sample test: the assessed person has to show a certain (complex) skill that is part of a competence.	- The scoring is more reliable than in a work sample test; - The desired action can be triggered by machines, tools, or other technical designs by pre-programming them in a certain way; - Useful when the assessing skill is technically oriented.	- Preparation is time-consuming; -Reduced representativeness raises questions about the meaning of the scores.
Low	Cognitive skill sample test: the assessed person has to show that he or she knows how to deal with a certain situation.	- Short preparation time; - Test can be done quickly; - Reliable scoring.	- Knowledge is a necessary but insufficient condition for competence; - High development costs.

The representativeness of assessment in a test situation can be high, average or low. The strengths and weaknesses of the test are outlined in Table 3. Based on these strengths and weaknesses, an organization can decide which kind of instrument they will use to assess an employee. The degree of representativeness of the results will depend on the used instrument.

2.4.2 Evaluation methods to assess competences

The three instruments distinguished by Straetmans and Sanders (2001) are useful but still too abstract for assessing the competences in this research. Maes and Sels (1999) provide an overview of the main evaluation methods in research. Based on Campbell et al. (2007), evaluation is defined in this research as:

"The systematic determination of the value of someone compared to a predetermined and agreed standard" (Campbell et al., 2007, p.14).

Assessment and evaluation are both focused on gathering and determining information of the value of a person. Evaluation differs from assessment by linking the value of a person explicit to a certain standard. This makes the evaluation methods of Maes and Sels (1999) valuable for this research. The methods are based on Kirkpatrick (1998) who stated that evaluation can take place on the level of 'reactions' and 'learning' which is done during the training of a competence, on the level of 'behaviour' which is done during the execution of the real job, and on the level of 'results' which is focused on the long term (e.g. higher labour productivity, cost reduction, and etc.). Maes and Sels (1999) discuss the several evaluation methods that are assigned to the different levels. Actually, these evaluation methods focus on the evaluation of company training and education programs, but

Maes and Sels (1999) also suggest that these evaluation methods evaluate the person itself rather than the training. Evaluation methods on the level of 'learning' and 'behaviour' are in line with the scope of this research; these are related to the extent to which participants change attitudes, increase knowledge, and/or increase skills (Sels, Bollen & Forrier, 2002). 'Learning' is described as "testing of knowledge, skills and attitudes" (Maes & Sels, 1999, p. 9). In this research it is not about evaluation during training but evaluation in a test situation. Because the term 'learning' can lead to confusion, it is divided in 'level of learning' and 'level of application'. The 'level of learning' is in line with knowledge and the 'level of application' is in line with skills. The level of behaviour is also relevant because that method evaluates during the execution of the job. With behaviour is meant whether a person can show a competence in a real work situation.

The evaluation methods that are assigned to the sub-levels 'knowledge' and 'skills' are summarized in Table 4. Based on Straetmans and Sanders (2001), the degree of representativeness is linked to the evaluation method. The evaluation methods described in Table 4 are useful when determining whether or not an employee is competent. Strengths and weaknesses are described, based on these an organization can decide which kind of method they will use to assess an employee. The advantage of the evaluation methods of Maes and Sels (1999) with respect to instruments described by Straetmans and Sanders (2001) is that the way of assessment is more explicit. These methods results in hard proof of being competent or not, where the proof of the instruments described by Straetmans and Sels (2001) may vary. Maes and Sels (1999) directly linked the evaluation methods to certain types of competences. This is shown in Table 4 under the heading strengths.

Table 4: Evaluating methods of knowledge and skills (Maes & Sels, 1999)

Evaluation Method	Description	Strengths	Weaknesses	Implications
Expertise profile	Evaluating the extent to which a person has mastered a competence graded on a five point scale.	- Evaluation of knowledge, skills and/or attitudes (level of learning and application); - Simplicity; - Effective; - Low input required from participants.	- Results are subjective.	Degree of representativeness: low.
Open questions	Aim to distinguish between people who know something about a topic and people who do not know anything about a topic. The participant must build an answer by him or herself.	- Evaluation of knowledge (level of learning); - Simplicity; - Flexible.	- Determining a 'good' answer; what is correct and what is wrong?	Degree of representativeness: low.
Multiple choice questions or true/false questions	MC questions consist of four of five alternative answers. In true/false questions (e.g. 'yes/no', 'agree/disagree') the number of alternatives is limited to two.	- Evaluation of knowledge (level of learning); - Quick method; - Improvement of this type of questions is simple.	- Designing this type of questions requires some accuracy.	Degree of representativeness: low.
Practical test	The participant has to carry out a certain task which is necessary to perform a job well.	- Evaluation of skills and/or attitudes (level of behaviour); - Results are highly comparable with the real work situation.	- Time-consuming; - It takes some resources.	Degree of representativeness: average to high. Disadvantages can be limited when evaluating during the execution of the job (as in the real work situation).
Case-study or lab and bench work	The participant is facing a challenging and realistic problem with the aim to suggest a solution for it and, in some cases, implement the solution in practice. Such method is known as 'lab and bench work' if the situation relates more to technical issues.	- Evaluation of knowledge, skills and/or attitudes (level of learning and application); - Realistic; - Flexible; - Results are comparable with the real work situation; - The content of the exercises can be customized easily.	- Limited generalizability of the results.	Degree of representativeness: average to high. Method is useful when evaluating competences such as problem analysis, problem solving, analytical thinking, and etc.

Scenario analysis	The participant has to analyse a written discussion or interaction.	-	Evaluation of knowledge, skills and/or attitudes (level of learning and application).	-	Less flexible and requires an accurate design; - Many characteristics of human interaction are lost due to the written nature of this method.	Degree of representativeness: low to average.
Pre/post-assessment form	The participant has to indicate to what extent he or she thinks to possess certain knowledge or skills. This is also done by his or her supervisor (or other stakeholders), ending with an evaluation or discussion about the differences between the two indications.	-	Evaluation knowledge, skills and/or attitudes (level of learning and application).	-	Results are subjective (but less subjective than results of the expert profile method).	Degree of representativeness: low (but higher than the degree of the expertise profile method).
Sentence completion	The participant is offered a sentence that must be completed. This evaluation can be done orally and in writing.	-	Evaluation of knowledge and/or attitudes (level of learning); - Simplicity; - Flexibility; - Testing thoroughly based on short, powerful questions.	-	Determining a 'good' answer; what is correct and what is wrong?	Degree of representativeness: low.
Multiple choice situation analysis	The participant is offered a simulation or description of a particular situation. After having read the description, he or she has to answer a couple of questions about that situation.	-	Evaluation of knowledge and/or attitudes (level of learning); - Quick method.	-	The method requires an accurate design.	Degree of representativeness: low.

2.4.3 The theory applied to Grolsch

The evaluation methods described by Maes and Sels (1999) are useful for this research because these methods resulting in hard proof whether or not an employee possesses a functional or cognitive competence. Based on Straetmans and Sanders (2001), the degree of representativeness is linked to each evaluation method. With this, a judgement can be made about the representativeness of the results that a method will yield. The evaluation methods described in Table 4 are all related in one way or another with the evaluation of functional or cognitive competences. Besides evaluating functional and cognitive competences, some methods are useful for evaluating the attitude of a person. Evaluating the attitude of a person is in line with the evaluation of social competences which is not included in this research. However, these methods are taken into account because these methods have also the possibility to evaluate functional and/or cognitive competences.

The purpose of the evaluation methods in this research is to link them to functional or cognitive competences. This linking is based on the requirements of output for proving to be competent. The evaluation methods must deliver the answer to the question whether or not employees in technical and maintenance functions in Grolsch possess functional and cognitive competences. With linking the methods to the relevant competences recommendations are made about how to assess needed competences for technical and maintenance functions.

2.5 Summary of used concepts

This chapter has provided an insight in the concept of competences and about methods to assess competences. The underlying perspectives of this research are the RBV and the Human Capital theory. Employees can provide a sustained competitive advantage, as long as they are unique and cannot be copied or substituted by competing organisations. In most cases, people in technical or maintenance functions at Grolsch do not possess unique human capital; they possess skills that are widely transferable. But these people are closely involved in the production of the end product, can make improvements in the efficiency of the production process and they have the potential to neutralize potential threats in the production process. With this they are closely involved in the achievement of certain KPIs. This ensures that they do have strategic value for the firm and contribute significantly to fulfil strategic purposes.

After the underlying theories a distinction is made between ‘competencies’ and ‘competences’. ‘Competence’ is in line with the UK approach; the focus is on functional aspects. ‘Competency’ is in line with the US approach; the focus is on the behavioural aspects. This research is focused on the professional knowledge and skills of the workers, so in line with ‘competences’.

Besides the distinction between ‘competence’ and ‘competency’, literature makes a distinction between different models with different types of competences. The holistic framework of Delamare Le Deist and Winterton (2005) provides an overall approach of competences. This model helped to identify the competences relevant in this research. Delamare Le Deist and Winterton (2005) distinguish four types of competences which are closely related to each other; functional competences, cognitive competences, social competences, and meta-competences. The focus in this research is on the knowledge and skills of employees in Grolsch, this implies that the focus is on the actual needed cognitive and functional competences. Social and meta-competences are not taken into account in this research due to a lack of time.

An assessment should take place to determine whether or not an employee possesses a functional or cognitive competence. By means of an assessment, the employee can prove whether or not he or she is competent. There are different ways conceivable in which information can be collected with the aim of ruling on whether a person is competent. The evaluation methods described by Maes and Sels (1999) are useful for this research; these methods resulting in hard proof whether an employee possess a functional of cognitive competence. These methods are useful when evaluating functional and/or cognitive competences. The evaluation methods used in this research are:

- Expertise profile;
- Open questions;
- Multiple choice questions or true/false questions;
- Practical test;
- Case-study or lab and bench work;
- Scenario analysis;
- Pre/post-assessment form;
- Sentence completion;
- Multiple choice situation analysis.

Cognitive competences are in line with the level of learning; it is about testing knowledge. Functional competences are in line with the level of application and the level of behaviour; it is about testing skills. Here, the level of application is in line with evaluation of skills in a test situation. The level of behaviour is in line with evaluation of skills in a real work situation.

Based on the theory a conceptual model is developed that will help in answering the research question. This model is presented in Figure 5.

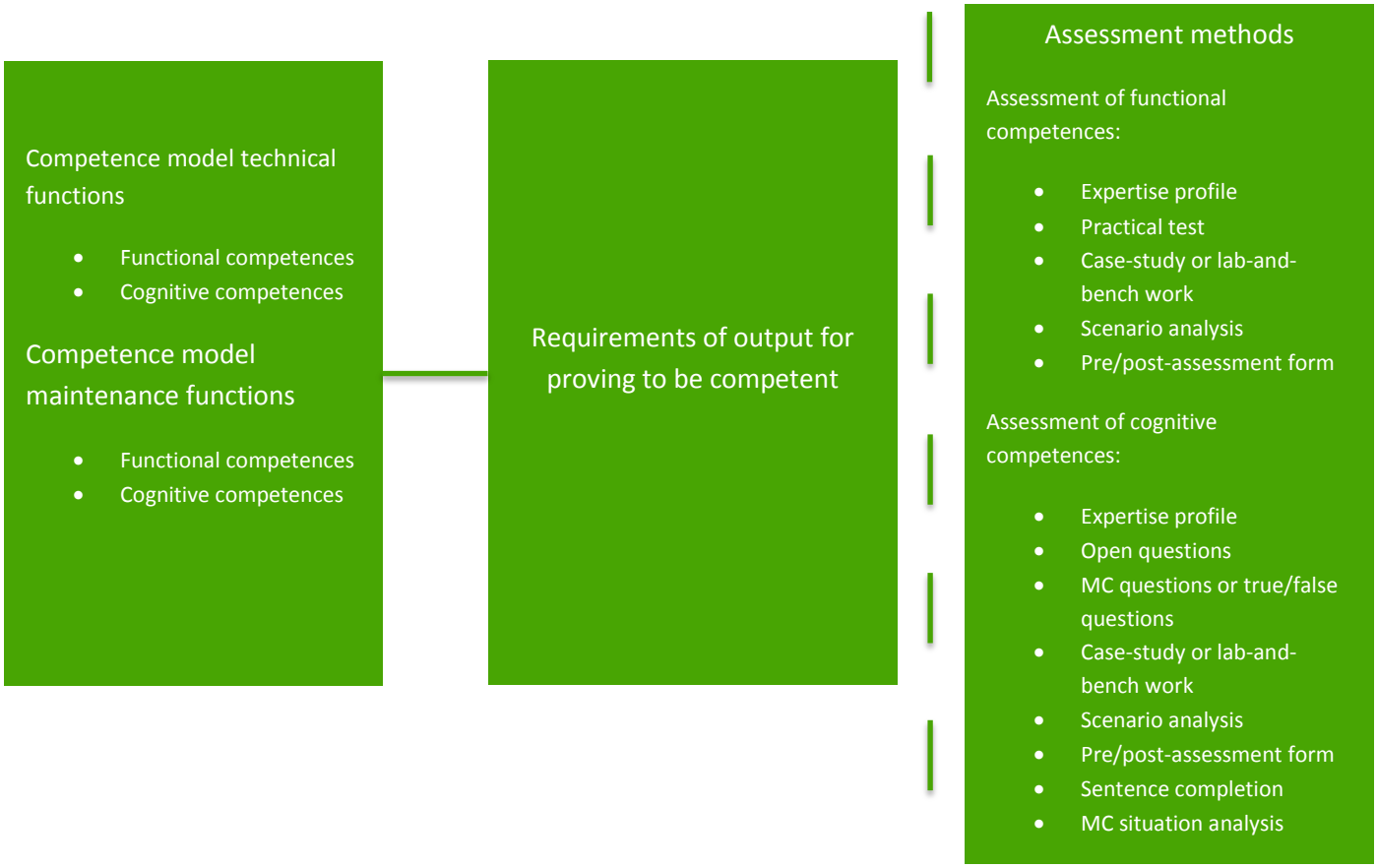

Figure 5: Conceptual model

First, the competence models for the technical and maintenance functions have to be specified. This means, specifying the needed functional and cognitive competences for technical functions and specifying the needed functional and cognitive competences for maintenance functions. When the final competence models for the technical and maintenance functions are made clear, the requirements of the output which are important for proving to be competent are explored. This information is important when linking the evaluation method to a competence. Based on these two steps, a conclusion is made about which assessment method is most suitable for assessing a certain competence. This will be done separately for each competence. The goal is that a judgement can be made whether an employee is competent, based on the assessment method assigned to each needed competence.

3. Research Methodology

This chapter consists of the methodological justification for the choices made in this research. The research activities for gathering the data will be explained and clarified. After this, the data collection method and the steps taken towards recommendations are discussed. This chapter ends with discussing the validity and reliability of the research.

3.1 Research design

The research has a prescriptive character, because the theory gives explicit prescriptions (e.g., methods, techniques, principles of form and function) which methods exist to assess functional and cognitive competences. This research is about saying how to do something (Gregor, 2006). The prescriptive character is in line with action research or design-oriented research. Design research is more practice-oriented rather than only theory-oriented, which makes it useful for this research. The purpose of design-oriented research is to solve an important practical problem (Järvinen, 2007). Based on Van Aken (2007), the following definition of design is used:

'A design is a solution to a problem, but it is a special kind of solution. It is not a solution to a pure knowledge problem but a solution to a field problem; the realization of a 'better' reality' (Van Aken, 2007, p. 68)

The purpose of the design in this research is to find a solution for the assessment of functional and cognitive competences for technical and maintenance functions. The design will be a competence model for technical functions and maintenance functions in which each competence is allocated to an evaluation method.

The steps that are followed are presented in Table 5. The research instruments that are used are discussed in the following paragraphs.

Table 5: Research phases

Phase	Theoretical description	Practical application
1. Pilot	Conducting a pilot to develop a final interview protocol in which all valid questions are taken into account.	- Document analysis - Interviews with experts
2. Developing the competence models	Defining the model of functional and cognitive competences by function.	- Document analysis - Interviews with experts
3. Exploration of requirements of output	Exploring the requirements regarding the evidence for whether or not being competent.	- A focus group of experts

3.1.1 Document analysis

Document analysis is used to formulate a first draft of a competence model. A document analysis is commonly referred to as content analysis. This technique is indirect rather than direct. Instead of directly observing, interviewing, or asking someone to fill in a questionnaire, the researcher has to deal with something produced for some other purpose (Robson, 1993). Internal documents are used in the pilot phase and in the phase developing the competence models. These internal documents consist of job descriptions of each function. The relevant documents are:

- Job description Utility Technician (Grolsch, 2011);
- Job description Instrument Technician (Grolsch, 2011);
- Job description Mechanical Technician (Grolsch, 2011);
- Job description Maintenance Planner (Grolsch, 2011);
- Job description Maintenance Controller (Grolsch, 2011).

The content of these job descriptions includes information about the purpose of the function, educational requirements, core tasks, and responsibilities. The core tasks are divided in sub-tasks. This data is necessary input for designing interview questions. With these documents a first draft can be made of the competence models for the technical and maintenance functions.

3.1.2 Semi-structured interviews

It is likely that the job descriptions are obsolete and incomplete. That is why interviews are used to finalize the competence models. Interviews are used to gather qualitative information about functional and cognitive competences. An interview is a kind of conversation; a conversation with a purpose. It appears to be a quite straightforward and non-problematic way of finding things out (Robson, 1993); in this case finding out which functional and cognitive competences are needed to perform well in a job. Face-to-face interviews offer the possibility of modifying the line of enquiry and following up interesting responses. A disadvantage is that it is a time-consuming instrument. Besides this, notes have to be written down or recorded tapes require a transcription (Robson, 1993). The interview questions will be formulated based on the draft of the competence models developed in the document analysis. To ensure an open character, semi-structured interviews are used. In these interviews the interviewer has worked out a set of questions in advance, but is free to modify their order based upon his perception of what seems most appropriate in the context of the 'conversation'. The interviewer may change the way they are worded, give explanations, and leave out particular questions which seem inappropriate with a particular interviewee (Robson, 1993). Based on Robson (1993), the semi-structured interview schedule includes:

- Introductory comments;
- List of topic headings and key questions to ask under these headings;
- The associated set of possible answers;
- Closing comments.

The purpose of the interviews is to finalize a competence model of functional and cognitive competence for each technical and maintenance function.

3.1.3 Focus group

A focus group is used to gather data about requirements of the output for proving to be competent. Focus groups are group interviews. A moderator guides the interview while a small group discusses the topics that the interviewer raises. What the participants in the group say during their discussions is the essential data. This data and insights would be less valuable without group interaction (Morgan, 1998). The fact that group interviews can produce useful data with relatively little direct input from the researcher may be a distinct advantage. The corresponding weakness is that the researcher has less control over the data being generated compared to individual interviewing (Morgan, 1988). The data generated from the focus group is used to give an advice about which evaluation method is most suitable for the assessment of a competence.

3.2 Selection of respondents

The objective of this research is to advise Grolsch on how to assess functional and cognitive competences of technical and maintenance functions. Within the research question two different function categories can be identified. Therefore, the research question can be split up into two sub-questions:

1. How to assess needed competences for technical functions at Grolsch to fulfil strategic purposes?
2. How to assess needed competences for maintenance functions at Grolsch to fulfil strategic purposes?

3.2.1 Respondents pilot

In order to ensure that the research is valid, a pilot is executed to develop a final interview protocol in which all valid questions are taken into account. Besides, it gives a first impression of a final competence model. The pilot is conducted based on operational functions: Line Operator Packaging, Allround Operator Packaging, and the Shift Technician Packaging. The respondents for these functions are selected based on the questions:

- Who is closely involved in the function?
- Who has proper knowledge of the requirements of a function to perform well in a job?
- Who would benefit from an accurate picture of needed functional and cognitive competences?

Based on these questions the choice is made to use the Unit Managers as respondents. There are two Unit Managers that are responsible for all three functions (n=2). These persons are closely involved to the functions and know best what employees in these functions should know and be able to do. In addition, they benefit from a good performance of operational functions because they are responsible for them. The employees of the functions studied are not included as respondents. The reason for this is the chance that they do not appoint certain competences because they think it is not important or they know they do not possess these competences and therefore might see this research as a threat, while Grolsch does see these as important competences.

3.2.2 Respondents interviews

The two categories in this research include multiple functions. The technical category consists of five functions:

- Utility Technician;
- Instrument Technician Packaging;
- Instrument Technician Brewing;
- Mechanical Technician Packaging;
- Mechanical Technician Brewing.

The maintenance category consists of four functions:

- Maintenance Planner Packaging;
- Maintenance Planner Brewing;
- Maintenance Controller Packaging;
- Maintenance Controller Brewing.

The respondents are selected based on the same questions as in the pilot phase. A total of three respondents are selected for the technical functions. The respondent for the Utility Technician is the Manager Engineering. The Manager Engineering is the supervisor for the function of Utility Technician. The respondent for the Instrument Technician Packaging and the Mechanical Technician Packaging is the Packaging Engineer and is one and the same person. This Packaging Engineer is the supervisor for the functions of the Instrument Technician Packaging and the Mechanical Technician Packaging. The respondent for the Instrument Technician Brewing and the Mechanical Technician Brewing is the Brewing Engineer and is also one and the same person. The Brewing Engineer is the supervisor for the functions of the Instrument Technician Brewing and the Mechanical Technician Brewing. This makes that the total number of respondents for the technical functions is three. These persons know best which functional and cognitive competences employees in technical functions should have to perform well in their job. In addition, they benefit from a good performance of technical functions because they are responsible for them.

The same Packaging Engineer and Brewing Engineer are also respondents for the maintenance functions. The Packaging Engineer is supervisor and with this a respondent for the function of Maintenance Planner Packaging and the Maintenance Controller Packaging. The Brewing Engineer is supervisor and with this a respondent for the function of Maintenance Planner Brewing and Maintenance Controller Brewing. The respondents for the maintenance functions differ slightly from the respondents in the technical functions. As in the technical functions, all the supervisors are included. These respondents are responsible for the performance of the corresponding functions, and thus have a benefit in this research. But for the maintenance functions, the Asset Care Engineer is also included. This person ensures the long term care of the equipment which is relevant for these functions. His knowledge is valuable because he is closely involved in these functions. The Packaging Engineer, Brewing Engineer, and Asset Care Engineer together know best which functional and cognitive competences employees in maintenance functions should have to perform well in their job.

The total number of respondents for the technical and maintenance functions together is four because the Packaging Engineer and the Brewing Engineer are responsible for multiple functions. The respondents are:

- Manager Engineering;
- Packaging Engineer;
- Brewing Engineer;
- Asset Care Engineer.

As in the pilot phase, the employees of the technical and maintenance functions studied are not included as respondent. The reason for this is the same as in the pilot; there is a chance that they do not appoint certain competences because they think it is not important or they know they do not possess these competences and therefore might see this research as a threat, while Grolsch does see these as important competences.

3.2.3 Respondents focus group

The respondents for the technical and maintenance functions for the interviews are also the respondents in the focus group; these are the same persons. So the focus group consists of:

- Manager Engineering;
- Packing Engineer;
- Brewing Engineer;
- Asset Care Engineer.

These people are most closely involved in the relevant functions, and are therefore most suitable to provide valid data. Three out of four are directly responsible for one or more relevant technical or maintenance functions. The fact that the respondents will benefit from the outcome of the research increases the willingness to cooperate.

3.3 Data collection

As mentioned earlier, a pilot is executed to ensure that the interview is valid. A first draft of the competence model is made based on the job descriptions of the functions. Based on this first draft, an interview protocol is developed with a relatively open character to ensure in-depth interviews. The interviews took 45 minutes, where 60 minutes were scheduled. The interviews with the two respondents in the pilot phase are taken separately. The interview protocol for the first interview is attached in Appendix C. Based on this interview, changes are made in the in the interview protocol. The interview protocol for the second interview is attached in Appendix D.

After this pilot, final changes and adaptions were made to the interview protocol in order to increase the validity of the interview. Two questions are added with reference to the description of a certain competence. After the second pilot interview two general questions are added concerning the validity of the results. These questions are about the duration of supervising the relevant function at Grolsch and what he or she studied. Also questions are added concerning the topics of the functions because the respondents in the pilot had some comments about these; these topics were not all relevant. The final interview protocol is attached in Appendix E. The final interviews are conducted in two weeks and each interview lasted about 45 minutes.

After the interviews, the respondents in the focus group are brought together in a room to discuss about the requirements regarding the evidence for whether or not being competent. The relevant competences are presented on a screen in order to provide a clear overview. The respondent discussed each competence separately and indicated how an employee must prove that he or she is competent. The qualitative input is used to assign the most appropriate evaluation method(s) to the functional and cognitive competences. This meeting lasted about 90 minutes.

3.4 Procedures

Data received from the document analysis is used to develop a first draft of the functional and cognitive competences. Educational requirements, core tasks, sub-tasks, and responsibilities mentioned in the job descriptions are analysed and data which is in line with functional or cognitive competences is used for the development of the first draft of the competence model.

The data received from the interviews is used to finalize the competence models for the relevant functions. The respondent could indicate whether or not a functional or cognitive competence is

applicable to a function. In addition, the respondent could indicate whether there were missing competences in the first draft of the competence model. These differences with respect to the first draft of the competence model are outlined. With techniques like repeating and summarizing answers data is considered as complete. It became clear during the interviews when the first draft of the competence model was not in line with the needed functional and cognitive competences to perform well in a job. Differences in answers between respondents are presented to them and these differences are discussed. Then, the respondents must reach an agreement on the final answer and with this on the data input for setting up the final competence model. The first draft of the competences obtained from document analysis together with the supplementary data gathered in the interviews has resulted in the establishment of the final competence models for technical and maintenance functions. These final competence models are checked by the respondents to ensure that they are interpreted correctly.

When the final competence models are developed, a focus group is used to explore which requirements of the output are important for proving to be competent on a functional or cognitive competence. All the respondents relevant for this research are brought together in one room. The competences are discussed separately and the respondents must indicate what they think the proof must be to evaluate whether an employee is competent. Input of the discussion is summarized and at the end of each discussion there must be an agreement between the respondents of the final data input. When there is no agreement between respondents, the input of the respondent(s) that is responsible for evaluation of the relevant function is preferred. The steps taken for the analysis of the data can be summarized as:

- Analysis of job descriptions;
- Development of first draft of the competence models;
- Analysis the data gathered in the interviews with respect to the needed functional and cognitive competences;
- Development of the competence models for technical and maintenance functions;
- Check by respondents;
- Development of the final competence models for technical and maintenance functions.
- Analysis the data gathered in the focus group with respect to the requirements of output.

Based on the results of this data and taking into account the strengths and weakness of evaluation methods, each functional and cognitive competence is linked to an evaluation method. With this, recommendations are given how to assess the functional and cognitive competences of technical and maintenance functions.

3.5 Validity and reliability of the research

The reliability and validity of the research are important indicators of the meaningfulness of the results. Reliability is defined as “that quality of the measurement method that suggests that the same data would have been collected each time in repeated observations” (Babbie, 2007, p. 143). It tells something about the consistency of the research (Cramer & Van der Zwaal, 2006; Maso, 2003). Validity is defined as “a measure that accurately reflects the concept it is intended to measure” (Babbie, 2007, p.146). According to Maso (2003) it means that no systematic errors are made in the research (e.g., a question is incorrect formulated, so something else is measured than intended) (Maso, 2003). It indicates to what extent alternative explanations may be responsible for the results

found. There is a distinction between internal and external reliability and validity. In this research 'internal' with reference to reliability and validity means; the reliability and validity of the research in Grolsch. With 'external' is meant; the reliability and validity of the research in another context.

The respondents are not randomly chosen, but are deliberately chosen. In asking respondents to provide information, you should ask yourself whether they can do so reliably (Babbie, 2007). The chosen respondents in this research are all closely involved, and three out of four respondents supervising one or more relevant functions. To create more willingness to cooperate among respondents, goals and the fact that the respondents have an interest in it too is made clear. The environment and conditions during the interviews are held as similar as possible and the respondents are not influenced by others or disturbing conditions. This contributes to the internal reliability of this research; when repeating the research in Grolsch the same data will be collected.

The pilot is carried out with the goal to measure if the interview was internally valid and understandable. After the pilot, changes and adaptions are made to the interview protocol in order to increase the validity of the interview. The pilot is executed with two Unit Managers of three operational functions. These functions are similar to the five relevant technical functions, but the functions are quite different compared to the relevant maintenance functions. A pilot with similar maintenance functions was not feasible, so this could suggest that the outcomes of the maintenance functions are less valid. The results of the interviews are checked by the corresponding respondent to verify if they are interpreted right. This guarantees the internal reliability of this research. Each respondent had some minor remarks on the transcriptions. These remarks are taken into account and the final versions of the functional and cognitive competences by function are completed. Before starting with the focus group, the final versions are checked again by the respondents to ensure that they agreed with it. Because this research is firm-specific, it is difficult to generalize the results to other organizations than Grolsch. Therefore, external validity is not applicable for this research.

The final competence models are used as input for the focus group. The respondents discussed about how an employee must proof that he or she is competent. The data obtained in the focus group was quite transparent which ensures that another researcher (probably) will achieve the same results. Most companies have job descriptions for their functions. So, the used research methods are also useful for the collection of data about competences in another context. Based on this gathered qualitative data and taking into account the strengths and weakness of evaluation methods, each functional and cognitive competence is linked to an evaluation method.

4. Results

This chapter reveals the analysis of the results retrieved from the document analyses, interviews with experts, and from the focus group. First, the results of the document analysis and the interviews will be presented. Based on this data, the final competence models are developed. It is followed by the results of the focus group in which the requirements for proving to be competent will be discussed. The results together are the input for the recommendations about how to assess needed competences.

4.1 Development of competence models

In this phase the results of the document analysis and the interviews for the relevant technical and maintenance functions are discussed. First, a draft of the functional and cognitive competences is developed based on the job descriptions. This is followed by the changes made based on the interviews. The result is that two final competence models are developed based on these steps; a competence model for the technical functions and a competence model for the maintenance functions.

4.1.1 Development of competence model based on document analysis

In this paragraph a draft of the competence models will be developed. First, a draft is made for the technical functions. After this, a draft is made for the maintenance functions. All documents are analysed separately and based on that analysis an overview of competences is made necessary in one or more technical or maintenance functions.

4.1.1.1 Competence model technical functions

A first draft of functional and cognitive competences for the Utility Technician, Instrument Technician, and Mechanical Technician is developed and presented in Table 6.

The competence models are based on the topics and the corresponding competences mentioned in the job descriptions. Some competences where named more than once in different topics. In the draft of the competence model these competences are not mentioned more than once; these are assigned to the most appropriate topic. As can be seen in Table 6, not many cognitive competences are identified based on the document analysis. 5S in the topic '5S and Safety' refers to a lean manufacturing concept which is in line with the WCM way of working. These principles are about workplace optimization.

Table 6: Competence model technical functions based on document analysis

Document Analysis
Operation and Process Control Operating according to quality norms and requirements (e.g. GMP-/HACCP-norm); Conducting Critical Control Points (CCP) checks. Registration of waste; Conducting short stop checks; Analysing results of wastage registration and short stop checks; Unloading of chemicals; Coaching of teams; Conducting software modifications; Using machinery and equipment; *Knowledge of CCP's in production process.*
Maintenance of Installations and Equipment Conducting maintenance on ventilation systems and sprinkler systems; Cleaning of machinery and equipment; Conducting autonomous maintenance (included lubrication and inspection); Monitoring the technical condition and performance of plant and machinery; Assisting team members in carrying out their maintenance tasks; Conducting condition monitoring; Troubleshooting for the benefit of utilities; Conducting administrative activities; Calibration of instrumentation; *Knowledge of priorities when rescheduling activities;* *Knowledge of how to reschedule activities and unsolved problems.*
Quality Checks and Analyses Conducting quality checks; Registration of the results of the quality checks.
Communication Usage of GAP list (to register issues, problems and opportunities for improvement); Usage of communication media; Supporting the training and coaching needs of the Shift Technician, Mechanical Technician, Instrument Technician, and the Allround Operator; Coordinating all activities performed by third parties to utility systems; Cooperating with Maintenance Planner/Controller to effectively deploy the technicians; *Knowledge of individual and team goals.*
Continuous Improvement Identifying trends and opportunities to reduce losses (using run/control charts, trend analyses, and other tools); Monitoring line/installation performances; Monitoring (dis)continue flows; Making proposals to improve the continuity and performances.
Problem Solving Problem-solving methods (i.e., Quick-fix routines, 5WHY and Root Cause Analysis (RCA)); Conducting a Fault Failure Analysis (FFA); Assisting team members with solving problems.
5S and Safety Carrying out household chores; Working according to the safety and 5S principles; Identifying and marking of unsafe situations; Writing out work permits to third parties.
Key to symbols: **Bold type** = Topic Regular type = Functional competence *Italic type* = Cognitive competence

4.1.1.2 Competence model maintenance functions

Based on the job description documents of the Maintenance Planner and Maintenance Controller a first draft of functional and cognitive competences is developed and presented in Table 7.

Table 7: Competence model maintenance functions based on document analysis

Document Analysis
Scheduling Maintenance Activities Assigning employees for performing tasks; Communicating maintenance schedules; Coordinating maintenance personnel planning; Verifying of routine maintenance activities; Complementing administrative and system maintenance tasks; Provide feedback about efficiency of maintenance tasks to teams.
Managing Maintenance Systems Managing maintenance systems; Maintenance scheduling; Collecting the data in maintenance system; Conducting analysis to determine the cause of maintenance problems; *Knowledge when to repair or to replace a component.*
Maintenance Planning Making maintenance tasks lists; Assisting team members with prioritizing tasks and allocating resources; Rescheduling unexecuted maintenance tasks; Facilitating maintenance evaluations; *Knowledge of priorities.*
Problem Solving Problem-solving methods (i.e., Quick-fix routines, 5WHY and Root Cause Analysis (RCA)); Assisting team members with problem solving.
Optimizing and Coordinating Maintenance Implementing maintenance schedules; Managing the execution of maintenance activities.
Checking Performed Maintenance Ensuring that tasks are executed; Ensuring availability of spare parts; Analysing SAP maintenance system; Allocation of resources; *Knowledge of stocks.*
Ensuring Asset Care Integrity Ensuring asset care business processes; Place determining of installations, equipment, spare parts, documentation, and systems.
Key to symbols: **Bold type** = Topic Regular type = Functional competence *Italic type* = Cognitive competence

SAP is a computer program with regard to the management of maintenance that is used in Grolsch. As for technical functions, not much cognitive competences can be identified based on the job descriptions. This is in contrast to the number of functional competences that are identified based on the job descriptions. The next step is to find out whether the competences identified in the document analysis are relevant for a technical or maintenance function to perform well.

4.1.2 Development of final competence model based on interviews

The interview protocol for this phase is attached in Appendix E. Based on the input of the respondents in the interviews changes are made in the frameworks of functional and cognitive competences developed in the previous phase. These changes with respect to the first draft of the competence models are discussed in this paragraph.

4.1.2.1 Final competence model technical functions

Table 8 gives an overview of the changes made based on the interviews. These changes are presented in the second column. A minus means that it is not taken into account for the final competence model, a plus means that it is taken into account as a needed competence to perform well, and an asterisk means that the competence is placed in a different topic. An overview of the final competences is presented in the third column. This third column represents the final model of competences and is based on the document analysis and the interviews.

As can be seen in Table 8, the topic of technical skills is added to the model of competences. Respondents mentioned in the interviews the using of technical skills as a standalone topic because working with machinery and equipment is the core of the technical functions. To perform well, the employee must know how to use a machine. Coaching and assisting competences are not seen as relevant competences for the technical functions. Respondents indicated that it is important to help other team members, but that it is not a competence to perform well in the job. It is seen as something that should be obvious. The topic of problem solving and the corresponding competence is placed under operation and process control because it is seen as a competence applicable in the whole production process. When there is a problem, and this could be in any stage of the production process, methods should be used to find the core of the problem and to find a solution to solve this problem. Three competences are not seen as important for maintenance of installations and equipment, where two other competences are added. 'Making maintenance plans and standard operating procedures (SOP's)' are seen as tasks for a technical function, so these employees must be competent on these competences. 'Registration of the results of the quality checks' is not seen as a standalone competence; it is already covered in the competence 'conducting quality checks'. 'Conducting safety measurements for certain chemicals' is seen as a needed competence. It is important that this is carried out in a safe way in line with the legal requirements.

'The usage of machinery and equipment' is seen as the core of the function. That is why 'knowledge of the whole process' (e.g. the function of machines in process and how to relate to each other) is important according to the respondents. The last competence that is seen as important is 'knowledge about WCM'. Grolsch implemented the WCM way of working in 2010. To make this to success employees should know what this way of working means.

The third column represents an overview of the final needed functional and cognitive competences for the five technical functions to perform well. Not all these competences are needed in each function. The functions are discussed separately which resulted in an overview of competences for the five functions together. The relevant competences for each function separately are mentioned in Appendix F.

The competences are divided into seven topics. These topics are comparable with the topics in the job descriptions, but some minor changes are made. As can be seen in the Table 8, much more

functional competences than cognitive competences are needed to perform well in a technical function.

4.1.2.2 Final competence model maintenance functions

Table 9 gives an overview of the changes made based on the interviews. These changes are presented in the second column. An overview of the final competences is presented in the third column.

When discussing the draft of the competence model for maintenance functions with respondents, it became clear that the job descriptions used are outdated. The content of the maintenance functions is changed considerably in the last two years. With this, respondents consider the structure of topics and competences of the draft not as appropriate anymore. The respondents have chosen a different way of approach to be used for the identification of the needed functional and cognitive competences. The maintenance functions are cut into pieces which resulted in ten main topics of competences. In total, twelve functional competences and five cognitive competences are added. Sixteen functional competences are seen as not needed anymore in the job to perform well.

The third column represents an overview of the final needed functional and cognitive competences for the four maintenance functions to perform well. As for the technical functions, not all competences are needed for each function separately. The relevant competences for each function separately are mentioned in Appendix G. The main process of a maintenance function is mapped and the 'process steps' are taken as the main topics of a maintenance function. As can be seen in the third column of Table 9, not all topics required specific cognitive competences. As for the technical functions, more functional competences than cognitive competences are needed to perform well.

Table 8: Development of final competence model technical functions based on document analysis and interviews

Document Analysis	Interviews	Final Competences
Operation and Process Control Operating according to quality norms and requirements (e.g. GMP-/HACCP-norm); Conducting Critical Control Points (CCP) checks. Registration of waste; Conducting short stop checks; Analysing results of wastage registration and short stop checks; Unloading of chemicals; Coaching of teams; Conducting software modifications; Using machinery and equipment; *Knowledge of CCP's in production process.*	(-) Unloading of chemicals; (-) Coaching of teams. (*) Problem-solving methods (i.e., Quick-fix routines, 5WHY and Root Cause Analysis (RCA)); (*) Conducting a Fault Failure Analysis (FFA).	**Operation and Process Control** Operating according to quality norms and requirements (e.g. GMP-/HACCP-norm); Registration of waste; Conducting short stop checks; Analysing results of wastage registration and short stop checks; Problem-solving methods (i.e., Quick-fix routines, 5WHY and Root Cause Analysis (RCA)); Conducting a Fault Failure Analysis (FFA); Conducting software modifications.
Maintenance of Installations and Equipment Conducting maintenance on ventilation systems and sprinkler systems; Cleaning of machinery and equipment; Conducting autonomous maintenance (included lubrication and inspection); Monitoring the technical condition and performance of plant and machinery; Assisting team members in carrying out their maintenance tasks; Conducting condition monitoring; Troubleshooting for the benefit of utilities; Conducting administrative activities; Calibration of instrumentation; *Knowledge of priorities when rescheduling activities;* *Knowledge of how to reschedule activities and unsolved problems.*	(-) Conducting maintenance on ventilation systems and sprinkler systems; (-) Assisting team members in carrying out their maintenance tasks; (-) Conducting condition monitoring (+) Making maintenance plans; (+) Making standard operating procedures (SOP's).	**Maintenance of Installations and Equipment** Cleaning of machinery and equipment; Conducting autonomous maintenance (included lubrication and inspection); Monitoring the technical condition and performance of plant and machinery; Troubleshooting for the benefit of utilities; Making maintenance plans; Making standard operating procedures (SOP's); Conducting administrative activities; Calibration of instrumentation; *Knowledge of priorities when rescheduling activities.*
Quality Checks and Analyses Conducting quality checks; Registration of the results of the quality checks.	(-) Registration of the results of the quality checks. (*) Conducting Critical Control Points (CCP) checks; (*) *Knowledge of CCP's in production process.*	**Quality Checks and Analyses** Conducting quality checks; Conducting Critical Control Points (CCP) checks; *Knowledge of CCP's in production process.*

Communication Usage of GAP list (to register issues, problems and opportunities for improvement); Usage of communication media; Supporting the training and coaching needs of the Shift Technician, Mechanical Technician, Instrument Technician, and the Allround Operator; Coordinating all activities performed by third parties to utility systems; Cooperating with Maintenance Planner/Controller to effectively deploy the technicians; *Knowledge of individual and team goals.*	(-) Supporting the training and coaching needs of the Shift Technician, Mechanical Technician, Instrument Technician, and Allround Operator; (-) Cooperating with Maintenance Planner/Controller to effectively deploy the technicians. (*) *Knowledge of how to reschedule activities and unsolved problems.*	**Communication** Usage of GAP list (to register issues, problems and opportunities for improvement); Usage of communication media; Coordinating all activities performed by third parties to utility systems; *Knowledge of individual and team goals;* *Knowledge of how to reschedule activities and unsolved problems.*
Continuous Improvement Identifying trends and opportunities to reduce losses (using run/control charts, trend analyses, and other tools); Monitoring line/installation performances; Monitoring (dis)continue flows; Making proposals to improve the continuity and performances.	(-) Assisting team members with solving problems.	**Continuous Improvement** Identifying trends and opportunities to reduce losses (using run/control charts, trend analyses, and other tools); Monitoring line/installation performances; Monitoring (dis)continue flows; Making proposals to improve the continuity and performances.
Problem Solving Problem-solving methods (i.e., Quick-fix routines, 5WHY and Root Cause Analysis (RCA)); Conducting a Fault Failure Analysis (FFA); Assisting team members with solving problems.	(-) Assisting team members with solving problems.	
5S and Safety Carrying out household chores; Working according to the safety and 5S principles; Identifying and marking of unsafe situations; Writing out work permits to third parties.	(+) Conducting safety measurements for ammonia, carbon dioxide, and etc.; (+) *Knowledge of WCM.*	**5S and Safety** Carrying out household chores; Working according to the safety and 5S principles; Identifying and marking of unsafe situations; Conducting safety measurements for ammonia, carbon dioxide, etc.; Writing out work permits to third parties; *Knowledge of WCM.*
	(+) **Technical Skills** (+) *Knowledge of utility process.* (*) Using machinery and equipment.	**Technical Skills** Using machinery and equipment; *Knowledge of utility process.*
Key to symbols: **Bold type** = Topic Regular type = Functional competence *Italic type* = Cognitive competence	 (+) = Added competence (-) = Deleted competence (*) = Competence placed in other topic	

Table 9: Development of final competence model maintenance functions based on document analysis and interviews

Document Analysis	Interviews	Final Competences
Scheduling Maintenance Activities Assigning employees for performing tasks; Communicating maintenance schedules; Coordinating maintenance personnel planning; Verifying of routine maintenance activities; Complementing administrative and system maintenance tasks; Provide feedback about efficiency of maintenance tasks to teams.	(-) Assigning employees for performing tasks; (-) Complementing administrative and system maintenance tasks; (-) Provide feedback about efficiency of maintenance tasks to teams. (+) Creating overviews of open work orders.	**Scheduling Maintenance Activities** Communicating maintenance schedules; Coordinating maintenance personnel planning; Verifying of routine maintenance activities; Creating overviews of open work orders.
Managing Maintenance Systems Managing maintenance systems; Maintenance scheduling; Collecting the data in maintenance system; Conducting analysis to determine the cause of maintenance problems; *Knowledge when to repair or to replace a component.*	(-) **Managing Maintenance Systems** (-) Managing maintenance systems; (-) Collecting the data in maintenance system; (-) Conducting analysis to determine the cause of maintenance problems.	
Maintenance Planning Making maintenance tasks lists; Assisting team members with prioritizing tasks and allocating resources; Rescheduling unexecuted maintenance tasks; Facilitating maintenance evaluations; *Knowledge of priorities.*	(-) **Maintenance Planning** (-) Assisting team members with prioritizing tasks and allocating resources; (-) Rescheduling unexecuted maintenance tasks; (-) Facilitating maintenance evaluations.	
Problem Solving Problem-solving methods (i.e., Quick-fix routines, 5WHY and Root Cause Analysis (RCA)); Assisting team members with problem solving.	**Problem Solving** (+) **and Continuous Improvement** (-) Assisting team members with problem solving.	**Problem Solving and Continuous Improvement** Problem-solving methods (i.e., Quick-fix routines, 5WHY and Root Cause Analysis (RCA)).
Optimizing and Coordinating Maintenance Implementing maintenance schedules; Managing the execution of maintenance activities.	**Coordinating Maintenance** (-) **Optimizing** (-) Managing the execution of maintenance activities.	**Coordinating Maintenance** Implementing maintenance schedules.
Checking Performed Maintenance Ensuring that tasks are executed; Ensuring availability of spare parts; Analysing SAP maintenance system; Allocation of resources; *Knowledge of stocks.*	(-) Ensuring that tasks are executed; (-) Ensuring availability of spare parts; (-) Analysing SAP maintenance system; (-) Allocation of resources. (+) Make, modify and close notifications of maintenance needs (in SAP); (+) Make, modify and close orders (in SAP); (+) Making an order request for materials and services. (*) *Knowledge when to repair or to replace a component.*	**Checking Performed Maintenance** Make, modify and close notifications of maintenance needs (in SAP); Make, modify and close orders (in SAP); Making an order request for materials and services; *Knowledge when to repair or to replace a component.*

	(-) Place determining of installations, equipment, spare parts, documentation, and systems. (+) *Knowledge of installation of equipment*; (+) *Knowledge of de-installation of equipment*.	**Ensuring Asset Care Integrity** Ensuring asset care business processes; *Knowledge of installation of equipment*; *Knowledge of de-installation of equipment*.
	(+) **Topic: Developing Preventive Maintenance Plans** (+) Reading and understanding equipment manuals; (+) Entering equipment information (in SAP); (+) *Knowledge of production process.* (*) Maintenance scheduling ((+) using the RCM methodology); (*) Making maintenance task lists.	**Developing Preventive Maintenance Plans** Reading and understanding equipment manuals; Maintenance scheduling (using the RCM methodology); Making maintenance task lists; Entering equipment information (in SAP); *Knowledge of production process*.
	(+) **Preparing Scheduled Maintenance** (+) Making capacity schedules; (*) *Knowledge of priorities*.	**Preparing Scheduled Maintenance** Making capacity schedules; *Knowledge of priorities*.
	(+) **Guaranteeing Availability of Materials and Services** (+) Making orders for components and external services; (+) Booking components on order; (+) Writing out work permits to third parties; (+) Maintenance of master data. (*) *Knowledge of stocks*.	**Guaranteeing Availability of Materials and Services** Making orders for components and external services; Booking components on order; Writing out work permits to third parties; Maintenance of master data; *Knowledge of stocks*.
	(+) **Analysing Maintenance System Data** (+) Identifying frequent problems (in SAP).	**Analysing Maintenance System Data** Identifying frequent problems (in SAP).
	(+) **General** (+) Working according to the safety and 5S principles; (+) *Knowledge of WCM*; (+) *Knowledge of asset management strategy*.	**General** Working according to the safety and 5S principles; *Knowledge of WCM*; *Knowledge of asset management strategy*.
Key to symbols: **Bold type** = Topic Regular type = Functional competence *Italic type* = Cognitive competence	(+) = Added competence (-) = Deleted competence (*) = Competence placed in other topic	

4.2 Requirements of output

In the previous section, the results are presented for the development of the competence models for technical and maintenance functions. A focus group is used to explore which requirements of output are important for proving to be competent on a functional or cognitive competence. The competences are discussed separately and the respondents must indicate what they think the proof must be to evaluate whether or not an employee is competent.

4.2.1 Requirements of output technical functions

The requirements of output for the functional and cognitive competences of technical functions are presented in Table 10. For all competences there was an agreement between the four respondents about the type of requirement of output.

As can be seen in Table 10, three different types of requirements are mentioned as output for proving to be competent on a functional or cognitive competence. These types of requirement are:

- Demonstrate in practice;
- Demonstrate with a test;
- Oral explanation.

With demonstration in practice is meant that an employee in a real work situation can proof whether or not he or she is competent. For example, an employee can proof by use of a conducted short stop check that he or she is competent on this functional competence. It is a competence which is dealt with on daily basis, so the respondents in the focus group mentioned that it can be assessed based on delivered work from practice.

With demonstration with a test is meant that an employee proves that he or she is competent on a certain competence by use of a developed test. This means that the proof of being competent will result from the result of a simulation situation. Respondents argued that by use of a test some influence can be exercised. This is seen as an advantage for e.g. problem solving competences. With customizing the tests, the company can determine the degree of difficulty and with this the company can assess whether or not an employee is competent on a certain competence. The results show that for some functional competences both, demonstration in practice and demonstration with a test can be useful. These competences can be evaluated in a real work situation, but when ‘nothing happens’ there is no hard proof that an employee is competent. This is mostly the case with identifying and monitoring competences. With demonstration with a test influence can be exercised, e.g. by changing parameters. The respondents argued that demonstration with a test is also required for one cognitive competence; knowledge of priorities when rescheduling activities. With a test can be proved whether or not an employee is able to prioritize activities.

The last requirement for proving being competent is to give an oral explanation. For most cognitive competences, respondents argued that being able to describe the content of the competence is sufficient for proving being competent. It is about describing important principles, describing the individual and team goals, and etc. Building a good answer by the employee self is seen as a good way to proof that he or she is competent. Where oral explanation is mostly referred as a requirement of output for cognitive competences, the respondents named it also for one functional

competence as requirement. The respondents argued that oral explanation was required for the competence of calibration of instruments. The knowledge behind the skills is seen as important.

Table 10: Requirements of output for competences of technical functions

Competences	Requirement of Output
Technical Skills	
Using machinery and equipment;	Demonstrate in practice
Knowledge of utility process.	Oral explanation
Operation and Process Control	
Operating according to quality norms and requirements (e.g. GMP-/HACCP-norm);	Demonstrate with a test
Registration of waste;	Demonstrate in practice
Conducting short stop checks;	Demonstrate in practice
Analysing results of wastage registration and short stop checks;	Demonstrate with a test
Problem-solving methods (i.e., Quick-fix routines, 5WHY and Root Cause Analysis (RCA));	Demonstrate with a test
Conducting a Fault Failure Analysis (FFA);	Demonstrate with a test
Conducting software modifications.	Demonstrate in practice
Maintenance of Installations and Equipment	
Cleaning of machinery and equipment;	Demonstrate in practice
Conducting autonomous maintenance (included lubrication and inspection);	Demonstrate in practice
Monitoring the technical condition and performance of plant and machinery;	Demonstrate in practice or with a test
Troubleshooting for the benefit of utilities;	Demonstrate with a test
Making maintenance plans;	Demonstrate in practice
Making standard operating procedures (SOP's);	Demonstrate in practice
Conducting administrative activities;	Demonstrate in practice
Calibration of instrumentation;	Demonstrate in practice and oral explanation
Knowledge of priorities when rescheduling activities.	Demonstrate with a test
Quality Checks and Analyses	
Conducting quality checks;	Demonstrate in practice
Conducting Critical Control Points (CCP) checks;	Demonstrate in practice
Knowledge of CCP's in production process.	Oral explanation
Communication	
Usage of GAP list (to register issues, problems and opportunities for improvement);	Demonstrate in practice
Usage of communication media;	Demonstrate in practice
Coordinating all activities performed by third parties to utility systems;	Oral explanation
Knowledge of individual and team goals;	Oral explanation
Knowledge of how to reschedule activities and unsolved problems.	Oral explanation
Continuous Improvement	
Identifying trends and opportunities to reduce losses (using run/control charts, trend analyses, and other tools);	Demonstrate in practice or with a test
Monitoring line/installation performances;	Demonstrate in practice or with a test
Monitoring (dis)continue flows;	Demonstrate in practice or with a test
Making proposals to improve the continuity and performances.	Demonstrate in practice
5S and Safety	
Carrying out household chores;	Demonstrate in practice
Working according to the safety and 5S principles;	Demonstrate in practice
Identifying and marking of unsafe situations;	Demonstrate with a test
Conducting safety measurements for ammonia, carbon dioxide, etc.;	Demonstrate in practice
Writing out work permits to third parties;	Demonstrate in practice
Knowledge of WCM.	Oral explanation
Key to symbols:	
Bold type = Topic	
Regular type = Functional competence	
Italic type = Cognitive competence	

4.2.2 Requirements of output maintenance functions

The requirements of output for the functional and cognitive competences of maintenance functions are presented in Table 11. Again, for all competences there was an agreement between the four respondents about the type of requirement of output.

Table 11: Requirements of output for competences of maintenance functions

Functional Competences	Requirement of Output
Developing Preventive Maintenance Plans	
Reading and understanding equipment manuals;	Oral explanation
Maintenance scheduling (using the RCM methodology);	Demonstrate in practice
Making maintenance task lists;	Demonstrate in practice
Entering equipment information (in SAP);	Demonstrate in practice
Knowledge of production process.	Oral explanation
Scheduling Maintenance Activities	
Communicating maintenance schedules;	Oral explanation
Coordinating maintenance personnel planning;	Demonstrate in practice
Verifying of routine maintenance activities;	Demonstrate in practice
Creating overviews of open work orders.	Demonstrate in practice
Preparing Scheduled Maintenance	
Making capacity schedules;	Demonstrate in practice
Knowledge of priorities.	Demonstrate with a test
Guaranteeing Availability of Materials and Services	
Making orders for components and external services;	Demonstrate in practice
Booking components on order;	Demonstrate in practice
Writing out work permits to third parties;	Demonstrate in practice
Maintenance of master data;	Demonstrate in practice
Knowledge of stocks.	Oral explanation
Coordinating Maintenance	
Implementing maintenance schedules.	Oral explanation
Checking Performed Maintenance	
Make, modify and close notifications of maintenance needs (in SAP);	Demonstrate in practice
Make, modify and close orders (in SAP);	Demonstrate in practice
Making an order request for materials and services;	Demonstrate in practice
Knowledge when to repair or to replace a component.	Oral explanation or demonstrate with a test
Analysing Maintenance System Data	
Identifying frequent problems (in SAP).	Demonstrate in practice or with a test
Problem Solving and Continuous Improvement	
Problem-solving methods (i.e., Quick-fix routines, 5WHY and Root Cause Analysis (RCA)).	Demonstrate with a test
Ensuring Asset Care Integrity	
Ensuring asset care business processes;	Oral explanation
Knowledge of installation of equipment;	Oral explanation
Knowledge of de-installation of equipment.	Oral explanation
General	
Working according to the safety and 5S principles;	Demonstrate in practice
Knowledge of WCM;	Oral explanation
Knowledge of asset management strategy.	Oral explanation
Key to symbols: **Bold type** = Topic Regular type = Functional competence *Italic type* = Cognitive competence	

As can be seen in Table 11, the same three types of requirements are mentioned as output for proving to be competent on a functional or cognitive competences as for technical functions. Besides, the same arguments apply for the use these three types of requirements. The main difference in results is that oral explanation is more often seen as a requirement of output for

functional competences of maintenance functions than for functional competences of technical functions. The respondents argued that functional competences which are hard to proof have to be explained orally. Based on this explanation a judgement can be made whether or not this explanation is sufficient to be declared as competent.

4.3 Competences linked to an evaluation method

In this section, an advice is given about how to assess needed competences of technical and maintenance functions. The evaluation methods of Maes and Sels (1999) are linked to the competences. The linking of evaluation methods to competences is based on the input of the respondents in the focus group and on Bloom's taxonomy of cognitive domains (Bloom, Krathwohl & Masia, 1956), hereafter referred to as "Bloom's". Bloom's is a well-defined and accepted tool for categorizing types of thinking into six different levels: knowledge, comprehension, application, analysis, synthesis, and evaluation (Crowe, Dirks & Wenderoth, 2008). The six levels are presented with sample verbs in Table 12.

Table 12: The taxonomy of Bloom et al. (1956)

Level	Definition	Sample Verbs
Knowledge	Employee recalls or recognizes information, ideas, and principles in the approximate form in which they were learned.	Write, List, Label, Name, State, Define
Comprehension	Employee translates, comprehends, or interprets information based on prior learning.	Explain, Summarize, Paraphrase, Describe, Illustrate
Application	Employee selects, transfers, and uses data and principles to complete a problem or task with a minimum of direction.	Use, Compute, Solve, Demonstrate, Apply, Construct
Analysis	Employee distinguishes, classifies, and relates the assumptions, hypotheses, evidence, or structure of a statement or question.	Analyse, Categorize, Compare, Contrast, Separate
Synthesis	Employee originates, integrates, and combines ideas into a product, plan or proposal that is new to him or her.	Create, Design, Hypothesize, Invent, Develop
Evaluation	Employee appraises, assesses, or critiques on a basis of specific standards and criteria.	Judge, Recommend, Critique, Justify

For this research, the major idea of the taxonomy is that the functional and cognitive competences can be arranged in a hierarchy from less to more complex. The levels are understood to be successive so that one level must be mastered before the next level can be reached (Crowe et al., 2008). To categorize the competences even more clearly for Grolsch, the six levels of Bloom's are divided into three levels:

- Level 1: knowledge and comprehension;
- Level 2: application and analysis;
- Level 3: synthesis and evaluation.

This redistribution ensures that the assigning of the evaluation methods to the competences is clearer. Based on the input of the focus group, Bloom's taxonomy and the (dis)advantages of the evaluation methods of Maes and Sels (1999), recommendations are given about how to assess needed competences for technical and maintenance functions.

4.3.1 Competences of technical functions linked to an evaluation method

In Table 13 competences of technical functions are linked to an evaluation method of Maes and Sels (1999) based on input from the focus group and based on the levels of Bloom's. According to the input of the focus group, the proof for functional competences is mostly about 'demonstrate something'. This is in line with level 2 of Bloom's. In some cases there is more than one evaluation method applicable for a competence. The practical test is in this case the most useful evaluation method and focuses mainly on evaluating skills. In this method the employee has to carry out a certain task which is necessary to perform a job well. The competences assigned to the practical test are mentioned by the respondents as the key functional competences for these technical functions. They agreed that employees have to show in real practice that they are competent. An advantage of the practical test is that the outcome of the evaluation method is highly comparable with the real work situation and so have a high degree of representativeness. This makes this evaluation method the most suitable for these functional competences. The fact that this method is time-consuming and will take some resources can be reduced by evaluating during the execution of the job. According to the respondents it is possible for these competences to do the assessment during the real work, either by watching (e.g. calibration of instruments) or analysing the end result (e.g. making maintenance plans). Crowe et al. (2008) assert that one level must be mastered before the next level can be reached. So when employees complete the practical test successfully, it suggests that they have the knowledge and understanding which are associated to the competence.

Competences in line with problem analysis, problem solving, and monitoring can be best evaluated with a case study or lab and bench work (for more technical issues). The respondents mentioned that these competences are hard to evaluate during the execution of the job which make a practical test in a real work situation not useful. According to the input in the focus group the requirements of output is related to demonstration with a test. This makes a case study, where the degree of representativeness of the results is average to high, most useful for evaluating these competences. With this method can be proven that employees comply with level two of Bloom's. It is a realistic method, in which results are comparable with the real work situation. Implementing the solution for a certain problem makes this method even more realistic. Because the content of the exercises can be customized easily, it is a useful method for evaluating the monitoring competences and see what the reaction is on unusual performances or unusual (dis)continue flows. According to the respondents monitoring and identifying are two competences that are connected to each other. It is said that the monitoring and identifying of (for example) performances can also be done in a real work situation, but a disadvantage in these is that if nothing happens it is hard to evaluate whether or not an employee is competent. The respondents want to see what the action of an employee is if/when they notice unusual performances or (dis)continue flows. This is made easier using a case-study or lab and bench work.

Table 13: Competences of technical functions linked to an evaluation method

Competences	Requirement of Output	Bloom et al.'s taxonomy	Evaluation Method
Technical Skills			
Using machinery and equipment;	Demonstrate in practice	Level 2	Practical test
Knowledge of utility process.	Oral explanation	Level 1	Open questions
Operation and Process Control			
Operating according to quality norms and requirements (e.g. GMP-/HACCP-norm);	Demonstrate with a test	Level 2	Various-points-in-time-assessment
Registration of waste;	Demonstrate in practice	Level 2	Practical test
Conducting short stop checks;	Demonstrate in practice	Level 2	Practical test
Analysing results of wastage registration and short stop checks;	Demonstrate with a test	Level 2	Case-study and scenario analysis
Problem-solving methods (i.e., Quick-fix routines, 5WHY and Root Cause Analysis (RCA));	Demonstrate with a test	Level 2	Case-study
Conducting a Fault Failure Analysis (FFA);	Demonstrate with a test	Level 2	Case-study
Conducting software modifications.	Demonstrate in practice	Level 2	Practical test
Maintenance of Installations and Equipment			
Cleaning of machinery and equipment;	Demonstrate in practice	Level 2	Practical test
Conducting autonomous maintenance (included lubrication and inspection);	Demonstrate in practice	Level 2	Practical test
Monitoring the technical condition and performance of plant and machinery;	Demonstrate in practice or with a test	Level 2	Practical test or case-study
Troubleshooting for the benefit of utilities;	Demonstrate with a test	Level 2	Case-study
Making maintenance plans;	Demonstrate in practice	Level 2	Practical test
Making standard operating procedures (SOP's);	Demonstrate in practice	Level 2	Practical test
Conducting administrative activities;	Demonstrate in practice	Level 2	Practical test
Calibration of instrumentation;	Demonstrate in practice and oral explanation	Level 2	Practical test
Knowledge of priorities when rescheduling activities.	Demonstrate with a test	Level 1	MC situation analysis
Quality Checks and Analyses			
Conducting quality checks;	Demonstrate in practice	Level 2	Practical test
Conducting Critical Control Points (CCP) checks;	Demonstrate in practice	Level 2	Practical test
Knowledge of CCP's in production process.	Oral explanation	Level 1	Open questions

Communication			
Usage of GAP list (to register issues, problems and opportunities for improvement);	Demonstrate in practice	Level 2	Practical test
Usage of communication media;	Demonstrate in practice	Level 2	Practical test
Coordinating all activities performed by third parties to utility systems;	Oral explanation	Level 2	Various-points-in-time-assessment
Knowledge of individual and team goals;	Oral explanation	Level 1	Open questions
Knowledge of how to reschedule activities and unsolved problems.	Oral explanation	Level 1	Open questions
Continuous Improvement			
Identifying trends and opportunities to reduce losses (using run/control charts, trend analyses, and other tools);	Demonstrate in practice or with a test	Level 2	Practical test, case-study, and scenario analysis Practical test and case-study
Monitoring line/installation performances;	Demonstrate in practice or with a test	Level 2	Practical test and case-study
Monitoring (dis)continue flows;	Demonstrate in practice or with a test	Level 2	Practical test
Making proposals to improve the continuity and performances.	Demonstrate in practice	Level 3	Practical test
5S and Safety			
Carrying out household chores;	Demonstrate in practice	Level 2	Practical test
Working according to the safety and 5S principles;	Demonstrate in practice	Level 2	Practical test and various-points-in-time-assessment
Identifying and marking of unsafe situations;	Demonstrate with a test	Level 2	Practical test, case study, and scenario analysis
Conducting safety measurements for ammonia, carbon dioxide, etc.;	Demonstrate in practice	Level 2	Practical test
Writing out work permits to third parties;	Demonstrate in practice	Level 2	Practical test
Knowledge of WCM.	Oral explanation	Level 1	Open questions

Key to symbols:

Bold type = Topic
Regular type = Functional competence
Italic type = Cognitive competence
Level 1 = Knowledge and understanding
Level 2 = Application and analysis
Level 3 = Synthesis and evaluation

A scenario analysis may also be useful when evaluating analysing and identifying competences. In these, it may be less time-consuming than the case-study method. The content of the method complies with the requirements of the respondents. In this method the (re)action of employees can be evaluated. For example, an employee must analyse wastage registration, indicate what his or her action will be and based on this the evaluator decides if the employee is competent or not.

'Operating according to quality norms and requirements' is according to the respondents also a competence which is hard to measure. An evaluator must observe an employee for a long time before a judgement can be made. It is a competence which is in line with application, so in line with level 2 of Bloom's. The respondents mentioned that it is not feasible to demonstrate this competence in practice. A pre/post-assessment form may be useful in these. The employee has to indicate to what extent he or she thinks to possess certain knowledge or skills. This is also done by his or supervisor, ending with an evaluation about the differences between the two indications. But in this case, it is not about 'pre' and 'post' because there is no training between the two points. It is about evaluating during various points in time until the person has been declared competent. That is why it is not named as pre/post-assessment but as 'various-points-in-time-assessment'. According to the respondents it is important that the employee has the knowledge of the quality norms and requirements, and that this knowledge is associated with a certain attitude. This makes the various-points-in-time-assessment useful to evaluate this competence. With this method knowledge and skills can be evaluated. This method may also be useful when evaluating the competence 'working according to safety and 5S principles' and 'coordinating all activities performed by third parties to utility systems'. These are comparable with 'operating according to quality norms and requirements'. Oral explanation is mentioned as requirement of output for 'coordinating all activities performed by third parties to utility systems'. Though, this competence is categorized to level two of Bloom's; it is not only about knowledge and understanding but also about application. This makes the various-points-in-time-assessment useful to assess this competence; this method has the possibility to evaluate knowledge and skills. A weakness of this method is that results are subjective, so the outcome depends on the observation of the evaluator. Besides this it is not feasible to keep an eye on an employee every single minute which makes the degree of representativeness low.

The respondents mentioned that the competence 'calibration of instrumentation' must be demonstrated in practice and explained orally. As mentioned earlier, Crowe et al. (2008) assert that one level must be mastered before the next level can be reached. So when employees complete the practical test successfully, it suggests that they also have the knowledge and understanding which are associated to the calibration of instruments.

According to the respondents, the proof for cognitive competences is mostly about 'explaining something'. These competences comply with level 1 of Bloom's. There are two evaluation methods that are suitable for assessing these competences; open questions and the multiple choice situation analysis. For the cognitive competences assigned to open questions it is important, according to the respondents, that employees can build an answer by themselves. Open questions are in these the most suitable method. It is a simple and flexible method to evaluate employees. The weakness of this method is to determine what is correct and what is wrong. This can be limited by capturing a number of aspects which must be mentioned in their answers.

The multiple choice situation analysis method is most suitable when it is about prioritizing activities. Because not all activities are equally important, employees must know which activity is the most important and which is less important when rescheduling activities. In the multiple choice situation analysis the employee is offered some activities that must be rescheduled and he or she has to prioritize them. It is a quick method, but it requires an accurate design.

There is one competence that is linked to level 3 of Bloom's: 'making proposals to improve the continuity and performances'. The employee has to make proposals based on integrating and combing his or her own ideas and thoughts. This is line with level 3 (i.e. synthesis) of Bloom's. However, as for more functional competences, this can be assessed with a practical test. An employee can prove with examples of proposals made that he or she is competent.

4.3.2 Competences of maintenance functions linked to an evaluation method

In Table 14 competences of maintenance functions are linked to an evaluation method of Maes and Sels (1999) based on input from the focus group and based on the levels of Bloom's. The same evaluation methods are useful when evaluating competences for maintenance functions as for technical functions. Again, the proof is in most cases about 'demonstrate something'. The practical test is suitable when evaluating the functional competences which are seen as the core of the job. The respondents agreed for these competences that employees have to show in real practice that they are competent. With the practical test level 2 of Bloom's is covered. The competences allocated to the practical test can be evaluated during the execution of the job. This limits the weaknesses of this method that it is time-consuming and that it takes too many resources.

A difference with the technical functions is the method for coordinating skills. A various-points-in-time-assessment is useful when evaluating coordinating skills for technical functions. A practical test is useful when evaluating coordinating skills for maintenance functions. The reason for this is a different interpretation of the two coordinating competences. For technical functions coordinating means 'managing or guiding in the right direction'. For maintenance functions coordinating means 'alignment of capacity and activities'. The respondents argued that the coordinating competence for maintenance functions can be demonstrated by examples of work done in practice, which makes a practical test suitable in these.

As for the technical functions, a case study is useful when evaluating problem solving skills and identifying skills. Identifying frequent problems in SAP and solving these problems with the use of prescribed methods are closely related. Evaluation of these competences can be taken together in one case-study which makes it less time-consuming. A scenario analysis may be useful when Grolsch wants to evaluate the identifying competences separately.

The functional competences that are assigned to the various-points-in-time-assessment are identified by the respondents as difficult to measure; there is no hard evidence that proves an employee is competent or not. For this reason, the respondents mentioned oral explanation as requirement of output for 'communicating maintenance schedules' and 'implementing maintenance schedules'. But according to Bloom's these competences are categorized to level 2. These competences must be evaluated over a long period before a proper judgement can be provided. This makes the various-points-in-time-assessment form useful. The degree of representativeness is low for this method, but when evaluating during a long period the degree of representativeness

increases. This evaluating can be done during the execution of the job. With the various-points-in-time-assessment the oral explanation is also taken into account according to Crowe et al. (2008).

'Reading and understanding of equipment manuals' can be evaluated with open questions. The respondents mentioned that for this competence it is important to understand what is written in the manuals. This is in line with level 1 of Bloom's. The respondents argued that 'ordinary' people will not understand the meaning of these manuals. With open questions the evaluator can decide whether or not an employee does understand the meaning of the manuals and so whether or not he or she is competent. Multiple choice questions may also be useful in these, but the advantage of open questions is to discuss the material in depth.

Open questions and the multiple choice situation analysis are the main two evaluation methods for evaluating cognitive competences. With open questions an employee has to formulate answers by him or herself. This makes it possible to evaluate whether an employee knows the important aspects of a competence. With a multiple choice situation analysis the evaluator can determine whether the knowledge of prioritizing and knowledge and understanding when to repair or replace components is sufficient.

Table 14: Competences of maintenance functions linked to an evaluation method

Competences	Requirement of Output	Bloom et al.'s taxonomy	Evaluation Method
Developing Preventive Maintenance Plans			
Reading and understanding equipment manuals;	Oral explanation	Level 1	Open questions
Maintenance scheduling (using the RCM methodology);	Demonstrate in practice	Level 2	Practical test
Making maintenance task lists;	Demonstrate in practice	Level 2	Practical test
Entering equipment information (in SAP);	Demonstrate in practice	Level 2	Practical test
Knowledge of production process.	Oral explanation	Level 1	Open questions
Scheduling Maintenance Activities			
Communicating maintenance schedules;	Oral explanation	Level 2	Various-points-in-time-assessment
Coordinating maintenance personnel planning;	Demonstrate in practice	Level 2	Practical test
Verifying of routine maintenance activities;	Demonstrate in practice	Level 2	Various-points-in-time-assessment
Creating overviews of open work orders.	Demonstrate in practice	Level 2	Practical test
Preparing Scheduled Maintenance			
Making capacity schedules;	Demonstrate in practice	Level 2	Practical test
Knowledge of priorities.	Demonstrate with a test	Level 1	MC situation analysis
Guaranteeing Availability of Materials and Services			
Making orders for components and external services;	Demonstrate in practice	Level 2	Practical test
Booking components on order;	Demonstrate in practice	Level 2	Practical test
Writing out work permits to third parties;	Demonstrate in practice	Level 2	Practical test
Maintenance of master data;	Demonstrate in practice	Level 2	Practical test
Knowledge of stocks.	Oral explanation	Level 1	Open questions
Coordinating Maintenance			
Implementing maintenance schedules.	Oral explanation	Level 2	Various-points-in-time-assessment
Checking Performed Maintenance			
Make, modify and close notifications of maintenance needs (in SAP);	Demonstrate in practice	Level 2	Practical test
Make, modify and close orders (in SAP);	Demonstrate in practice	Level 2	Practical test
Making an order request for materials and services;	Demonstrate in practice	Level 2	Practical test
Knowledge when to repair or to replace a component.	Oral explanation or demonstrate with a test	Level 1	Open questions and MC situation analysis
Analysing Maintenance System Data			
Identifying frequent problems (in SAP).	Demonstrate in practice or with a test	Level 2	Practical test, case-study, and scenario analysis
Problem Solving and Continuous Improvement			
Problem-solving methods (i.e., Quick-fix routines, 5WHY and Root Cause Analysis (RCA)).	Demonstrate with a test	Level 2	Case-study

Ensuring Asset Care Integrity			
Ensuring asset care business processes;	Oral explanation	Level 1	Various-points-in-time-assessment
Knowledge of installation of equipment;	Oral explanation	Level 1	Open questions
Knowledge of de-installation of equipment.	Oral explanation	Level 1	Open questions
General			
Working according to the safety and 5S principles;	Demonstrate in practice	Level 2	Practical test and various-points-in-time-assessment
Knowledge of WCM;	Oral explanation	Level 1	Open questions
Knowledge of asset management strategy.	Oral explanation	Level 1	Open questions

Key to symbols:

Bold type = Topic
Regular type = Functional competence
Italic type = Cognitive competence
Level 1 = Knowledge and understanding
Level 2 = Application and analysis
Level 3 = Synthesis and evaluation

4.4 Summary of findings

In this chapter the results are presented of the document analysis and the interviews. A first model of competences for technical and maintenance functions is developed based on job descriptions. The competences derived from the job descriptions are discussed in the interviews. Respondents indicated whether or not a competence is needed to perform well in a certain function and missing topics and competences are added. It has resulted in a final competence model for technical functions and a final competence model for maintenance functions. These models were the input for the focus group in which respondents indicated what the requirement of output for each competence is. The respondents indicated that this requirement can be a demonstration in practice, a demonstration with a test, or an oral explanation of the competence. The competence models with the requirements of output are used to link an evaluation method of Maes and Sels (1999) to a competence. There are six evaluation methods of Maes and Sels (1999) that are useful to evaluate needed competences of technical and maintenance functions; the practical test, the case study, the various-points-in-time-assessment, a scenario analysis, open questions, and a multiple choice situation analysis. These six methods can be divided in two groups:

- Evaluating competences in line with level 1 of Bloom's: open questions, multiple choice situation analysis;
- Evaluating competences in line with level 2 of Bloom's: practical test, case study, various-points-in-time-assessment, scenario analysis.

This means for Grolsch, when it is about evaluating cognitive competences the open questions method and the multiple choice situation analysis are useful methods. The advantages and disadvantages of these methods will decide which one is the most useful for evaluating a specific competence. There are four methods useful when it is about evaluating functional competences. The most useful method is the practical test; this method is closest to reality. It is not always feasible to use this method and for some competences it does not provide the desired result. Then, a case study or scenario analysis may be useful because these methods can be influenced by Grolsch (e.g. changing parameters to evaluate identifying skills). A various-points-in-time-assessment is most useful when evaluating competences that are hard to measure. This method can evaluate knowledge and skills, but a disadvantage is that results are subjective.

5. Discussion and conclusion

This chapter consists of the conclusions of this research, based on the literature (i.e. chapter two), the methodology (i.e. chapter three), and the results (i.e. chapter four). Besides this, the scientific contribution and limitations of this research will be discussed. It will end with recommendations towards future research and recommendations towards Grolsch.

5.1 Conclusions

In this section the conclusions are discussed with reference to the used literature, the methodology, and the results.

Straetmans and Sanders (2001) mentioned that disadvantages of evaluation in real practice are the risk of wrong conclusions due to limited number of tasks performed and problematic scoring of 'good' behaviour in work practice. This assertion can be challenged. The limited number of tasks performed can be negated by evaluating several times. This research has made clear that evaluation in a real work situation is useful and preferable when evaluating functional competences. When functional competences are specifically defined, the scoring of the competence is no problem. By linking evaluation methods to competences hard evidence is guaranteed. The assessed person knows which requirements he or she must meet, and the assessor knows what the requirements are to declare a person being competent.

Besides the disadvantage of problematic scoring, it is argued by Straetmans and Sanders (2001) that observation in a work situation is rather time-consuming. But when evaluating in a real work situation, the work can continue as normal. With this, there is no need to arrange another time and setting to evaluate a competence. This ensures that evaluating in a real work situation is relatively less time-consuming than evaluating in a test situation. In addition, the functional competences in this research that are assigned to evaluation in a real work situation can, in most cases, be evaluated by checking the result only. With this, there is no need to keep an eye on the assessed person every single minute during an assessment. Evaluating the result only limits the amount of time that an assessor needs to evaluate whether a person is competent.

In addition to the previous two conclusions, it is mentioned by Straetmans and Sanders (2001) that evaluation in real work situations is more related to the behaviour of a person and evaluation in test situations is more focused on evaluating separate competences and elements of competences. This research shows that this assertion is not valid. It is possible to evaluate separate competences in a real work situation, e.g. cleaning of machinery and equipment. The assessment of this competence has nothing to do with the behaviour of the assessed person.

When looking back on this research, it can be concluded that the execution of a pilot can be seen as redundant. The execution of the pilot took a couple of weeks in which three operational functions were analysed. The result of this pilot was the development of a final interview protocol in which a few changes and adaptions were made with reference to the first version of the interview protocol. It is questionable whether the time spend on this pilot do outweigh the benefits achieved. In the future, analysing one function instead of three functions in the pilot phase might be sufficient to develop a final interview protocol in which all valid questions are taken into account. This will take less time and resources.

A focus group is used to find out what the requirements are for proving to be competent. It can be concluded that the focus group was of little added value in the way it is used in this research. Respondents were asked for each competence separately what they thought the requirement of output must be for proving to be competent. Their input was summarily and it resulted in only three answers: demonstrate in practice, demonstrate with a test, and oral explanation. In addition, Bloom's taxonomy is used to categorize the competence and to link evaluation methods to competences. This ensured that the focus group was of little added value in this research. In the limitations is discussed how it could be done differently.

In chapter four, an answer is given to the research question. The needed functional and cognitive competences in technical and maintenance functions are specified. Each competence is linked to an evaluation method based on the requirements of output mentioned by the respondents in the focus group, Bloom's taxonomy, and the (dis)advantages of each evaluation method of Maes and Sels (1999). The used methods can be divided in two groups:

- Evaluating competences in line with level 1 of Bloom's: open questions, multiple choice situation analysis;
- Evaluating competences in line with level 2 of Bloom's: practical test, case study, various-points-in-time-assessment, scenario analysis.

There are almost no competences in line with level 3 of Bloom's. Level 3 of Bloom's is about synthesis and evaluation of knowledge and skills. Examples of these are; giving critique, judging delivered work of other people, and making recommendations. The focus in this research is on cognitive and functional competences, which are covered by level 1 and level 2 of Bloom's. In addition, it is questionable whether competences that are in line with level 3 of Bloom's are needed in technical and maintenance functions to perform well. This level of Bloom's does not seem to apply to the functions in this research, but rather apply to the functions above them (i.e. the supervising functions).

There are also a couple of methods of Maes and Sels (1999) which do not appear to be useful to evaluate competences of technical and maintenance functions; the expertise profile, the multiple choice questions or true/false questions, and the sentence completion method. According to Maes and Sels (1999) these methods are useful for evaluating the impact of company training and education programs, but the advantages of these methods do not outweigh the advantages of the methods used in this research when evaluating whether or not a person is competent. Based on this it can be concluded that not all evaluation methods of Maes and Sels (1999) are appropriate for assessing whether an employee is competent.

At the end, this research demonstrates that is possible to link specified competences to an evaluation method which enables Grolsch to find hard proof whether a person is competent on certain knowledge and/or skills.

5.2 Scientific contribution

With this research, it is proven that developing a model of need competences not always ends disappointing in a list of relevant competences which are no more than general, abstract formulations with any hard meaning, e.g. give constructive feedback. This research shows that it is possible to link methods to competences which result in hard evidence about whether or not being

competent. The degree of concreteness will increase by linking competences to an evaluation method.

The assertion that the evaluation methods of Maes and Sels (1999) evaluate the person itself rather than a training program can be confirmed. In the article of Maes and Sels (1999) the evaluation methods are only used for evaluating the impact of a company training or education program, but this research confirmed that some of these methods are useful when evaluating competences of persons. It should be said that not all evaluation methods are even useful for the evaluation of competences.

5.3 Limitations

The input of the respondents during the interviews might be influenced by training programs that already exist within Grolsch. Some respondents referred in the interview to existing training programs. They mentioned that an employee must possess a certain functional or cognitive competence because there are already associated training programs available within the company. It is discussable whether this is the right way of reasoning. It is reasonable to assume that those training programs are designed to develop employees on certain necessary competences, but not all these training programs might be beneficial for an employee in order to perform successfully.

As mentioned in the conclusions, the input of the respondents in the focus group was summarily. For most functional competences the input was no more than the employee should 'demonstrate it in practice' or 'demonstrate it with a test'. For most cognitive competences the input was no more than 'oral explanation'. In some cases, more additional input was given with respect to the feasibility of assessment methods. When a different approach was chosen for the focus group, other results may show up. Evaluation methods could be explained first to the respondents, and based on the strengths and weaknesses of these methods the respondents could give an advice which method is most suitable. When using the approach in this research, the question is whether the focus group was really of added value for answering the research question because the taxonomy of Bloom et al.'s (1956) is used also to categorize the competences and based on (dis)advantages of each method competences are linked.

5.4 Recommendations towards future research

Now it is made clear how to assess needed functional and cognitive competences for technical and maintenance functions the question arises: how many practical tests, case-studies, open questions, and etc. must be done to decide whether or not an employee is competent. It is not likely that this number is the same for each functional and cognitive competence. In addition, for some competences one practical test may be sufficient where another competence requires more than one practical test. And the question is whether or not there is a difference in the amount of tests between functional and cognitive competences.

A second question that arises is whether competences must be evaluated only once, or should it be a recurring phenomenon; evaluation every year, every two years, and etc. This question relates to the previous question. It is about cherishing competences; how can an organisation ensure that competences are maintained at a certain level?

A third issue for future research is the question which competences are the most important. Now the competences are linked to an evaluation method the actual evaluation can take place. But which

competence must be evaluated first? The degree of importance affects also the process after the evaluation. The purpose of the evaluation of competences is to identify the competences that employees do not possess. When there are several competences that must be developed the degree of importance will decide which competence must be developed first. Based on Bloom's, it is likely that the competences that are in line with level 1 have the first priority, considering the assertion that levels are understood to be successive so that one level must be mastered before the next level can be reached. But it becomes more difficult when it is about prioritizing competences which are on the same level of Bloom's.

It is concluded that the needed functional and cognitive competences are in line with level 1 and level 2 of Bloom's. It is questionable whether the used evaluation methods of Maes and Sels (1999) are also useful for the evaluation of competences in line with level 3 of Bloom's. According to the results, one competence is in line with level 3 of Bloom's. That competence is linked to a practical test, because with examples of developed proposals the employee can prove that he or she is competent. But it is not guaranteed that a practical test is always useful to evaluate competences in line with synthesis and evaluation of knowledge and skills. It is an interesting subject for future research to find out which evaluation methods are useful for evaluating competences in line with level 3 of Bloom's.

5.5 Recommendations towards Grolsch

A first recommendation is to update the job descriptions of maintenance functions. Where the job descriptions were useful for developing a first draft of the competence model for technical functions, the job descriptions of the maintenance functions were outdated. An update of the job descriptions is necessary to align the job descriptions with the developed competence models for technical and maintenance functions. If Grolsch continues to use these outdated job descriptions it will end in confusion about the needed competences in the functions to perform well.

In addition to an update of the job descriptions, Grolsch must ensure that needed competences in the future are added to the existing competence model. The content of the functions is changing rapidly considering that the job descriptions are developed in 2011 and already are outdated. This makes keeping the list of competences up to date important.

Now the competence models for technical and maintenance functions are made clear and evaluation methods are assigned to the competences, methods must be developed in practice. This means the development of practical tests, case-studies, open questions, and etc. This may take some time and resources, but at the end it will result in assessments allowing the gathering of valuable information about the available functional and cognitive competences of technical and maintenance teams in the company. The evaluation of some competences can be taken together which reduces the amount of time and resources.

When developing the competence models, it is argued by the respondents that coaching and assisting competences are not seen as relevant competences. The respondents indicated that it is important to help other team members, but that it is not a competence to perform well in a job. It is seen as something that should be obvious. This way of thinking seems to be too simplistic. It does not go without saying that people help each other when they are working in teams. Grolsch should discuss with their employees why it is important to help each other. Good team work is important to

achieve goals and with this an important competence to perform well in a job, despite the fact that it is a competence which is hard to measure.

The focus in this research is on functional and cognitive competences. But based on the literature, it can be concluded that can be regarded as not sufficient. However, the choice for analysing the functional and cognitive competences of employees is explained in chapter two. The starting point of this research is defining the requirements for a good job performance. It would be too time-consuming to analyse all the types of competences and the question is whether it is possible to find hard proof for evaluating competences in line with attitudes. As in many cases, here, competence management is about the development of competence profiles and personal training focused on the visible tip of the iceberg, the first two types of competences. The underlying layers of the iceberg are getting little to no attention, while these skills, values, standards, ethics and motives are the foundations of the functional and cognitive competences. These are the incentives that make development of functional and cognitive competences possible. Based on this it can be concluded that evaluating functional and cognitive competences only is not sufficient. Grolsch should also pay attention to the underlying aspects of employees.

The last recommendation towards Grolsch is to clearly communicate the outcome of this research to the employees in technical and maintenance functions. Employees in these functions may see the assessment of competences as a threat. Grolsch must ensure that it is made clear that the assessments are not used to condemn someone who is not competent on a certain functional or cognitive competence. The assessments are used to clarify the competences that should be developed. When communicating the purpose of the evaluation methods, Grolsch should focus on the benefits that employees can take out with the implementation of the assessments of competences. They are given the opportunity to develop themselves.

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Appendices

A. Description of SABMiller

SABMiller is one of the world's leading brewers with more than 200 beer brands and some 70,000 employees in over 75 countries. The company has also growing businesses in soft drinks and they are one of the world's largest bottlers of Coca-Cola products.

SABMiller has become a global leader by doing business locally, pursuing operational excellence and offering high-quality products backed by innovation and a commitment to sustainability. The portfolio of SABMiller includes premium international beers such as Pilsner Urquell, Peroni Nastro Azzurro, and Grolsch, as well as Castle, Miller Lite, Snow, Tyskie and Victiora Bitter.

SABMiller created leading positions in both emerging and developed markets across the world. Their portfolio of businesses spans six regions which in the year ended 31 March 2012 together sold 229 million hectolitres of lager, and delivered revenues of US$31,338 million with earnings before interest, tax, amortisation and exceptional items (EBITA) of US$5,634 million.

The **vision** of SABMiller is:

To be the most admired company in the global beer industry.

The **mission** of SABMiller is:

To own and nurture local and international brands which are the first choice of the consumer.

The **values** of SABMiller are:

- People are enduring advantage;
- Accountability is clear and personal;
- Work and win in teams;
- Understanding and respect customers and consumers;
- Reputation is indivisible.

(Retrieved from www.sabmiller.com)

B. Relevant functions in research

Type	Function	Department	Definition
Operational (pilot)	Allround operator	Packaging	The primary role of the Allround Operator is working according to the work instructions, safely operation of all task areas of all production lines in the unit. Specific knowledge of at least two key areas, performing quality checks and performing autonomous maintenance.
Operational (pilot)	Line operator	Packaging	The primary role of the Line Operator is working according to the work instructions, safely operation of task areas within his production line, performing quality checks en performing autonomous maintenance. The line operator has specific knowledge of at least one key area.
Operational (pilot)	Shift Technician	Packaging	The primary role of the Shift Technician is performing his work according to the work instructions, performing non-destructive quality checks en performing. The primary focus of the Shift Technician is on the asset care activities of the team.
Maintenance	Maintenance Controller	Packaging Brewing	The primary role of the Maintenance Controller is to coordinate, coach and control the activities of the level 1 maintenance team and the provision of specialized technical knowledge to guarantee maximum availability of plants.
Maintenance	Maintenance Planner	Packaging Brewing	The primary role of the Maintenance Planner is to manage the relevant maintenance systems, developing routines and planned maintenance schedules and supporting the maintenance team in performing maintenance.
Technical	Mechanical Technician	Packaging Brewing	The primary role of the Mechanical Technician is transferring specialized equipment and installation knowledge to the team to support the daily maintenance operations and problem-solving actions.
Technical	Instrument Technician	Packaging Brewing	The primary role of the Instrument Technician is taking care of specialized instrumentation, software and interface knowledge to Operations to support the daily operations, and performing maintenance and problem-solving actions.
Technical	Utility Technician	Brewing	The primary role of the Utility Technician is operating the utility installations (energy building, waste water purification and pipe bridge), coordinating and performing his work according to the work instructions, performing quality checks and performing routine maintenance in collaboration with the technicians in brewing. The Utility Technician is closely involved in optimizing the utility installations.

C. Semi-structured interview protocol competence model (in Dutch) pilot #1

Ten eerste wil ik u bedanken voor uw medewerking aan dit onderzoek. Dit gesprek heeft als doel om de kennis en vaardigheden in kaart te brengen die benodigd zijn om de functie van ... binnen Grolsch naar behoren uit te oefenen. Dit gesprek zal ongeveer 60 minuten duren.

Algemene vragen:

- Wat is uw naam?
- Wat is uw leeftijd?
- Wat is uw functie?

Topics Line Operator
1. Operatie en procescontrole
2. Onderhoud van installaties en machines
3. Kwaliteitscontrole en analyses
4. Communicatie
5. Probleem oplossen
6. Continu verbeteren

Topics Allround Operator
1. Operatie en procescontrole
2. Onderhoud van installaties en machines
3. Kwaliteitscontrole en analyses
4. Communicatie
5. Probleem oplossen
6. Continu verbeteren

Topics Shift Technician
1. Operatie en procescontrole
2. Onderhoud van installaties en machines
3. Kwaliteitscontrole en analyses
4. Communicatie
5. Probleem oplossen
6. Continu verbeteren
7. Veiligheid en 5S

1. Het bespreken van de verschillende competenties per topic

- Is dit een competentie die toebehoort tot deze functie?
    - Zo ja, ga door naar de volgende vraag.
    - Zo nee, waarom niet?
- Ontbreken er competenties in dit topic?
    - Zo nee, ga door naar 3.
    - Zo ja,
        - Welke competentie ontbreekt er in dit topic?

2. De laatste check

- Ontbreken er nog competenties voor de functie van ...?
    - Zo nee, ga door naar de volgende vraag.
    - Zo ja, welke competenties ontbreken er?
- Heeft u nog overige op- of aanmerkingen?
    - Zo ja, welke op- of aanmerkingen heeft u?

Ik wil u hartelijk danken voor uw medewerking aan dit onderzoek. De resultaten zullen binnen twee weken aan u worden voorgelegd.

D. Semi-structured interview protocol competence model (in Dutch) pilot #2

Ten eerste wil ik u bedanken voor uw medewerking aan dit onderzoek. Dit gesprek heeft als doel om de kennis en vaardigheden in kaart te brengen die benodigd zijn om de functie van ... binnen Grolsch naar behoren uit te oefenen. Dit gesprek zal ongeveer 60 minuten duren.

Algemene vragen:

- Wat is uw naam?
- Wat is uw leeftijd?
- Wat is uw functie?

Topics Line Operator
7. Operatie en procescontrole
8. Onderhoud van installaties en machines
9. Kwaliteitscontrole en analyses
10. Communicatie
11. Probleem oplossen
12. Continu verbeteren

Topics Allround Operator
7. Operatie en procescontrole
8. Onderhoud van installaties en machines
9. Kwaliteitscontrole en analyses
10. Communicatie
11. Probleem oplossen
12. Continu verbeteren

Topics Shift Technician
8. Operatie en procescontrole
9. Onderhoud van installaties en machines
10. Kwaliteitscontrole en analyses
11. Communicatie
12. Probleem oplossen
13. Continu verbeteren
14. Veiligheid en 5S

3. Het bespreken van de verschillende competenties per topic

- Is dit een competentie die toebehoort tot deze functie?
    - Zo ja, ga door naar de volgende vraag.
    - Zo nee, waarom niet?
- Wat moet de beoordeelde kennen en/of kunnen met betrekking tot deze competentie?
- Ontbreken er competenties in dit topic?
    - Zo nee, ga door naar 3.
    - Zo ja,
        - Welke competentie ontbreekt er in dit topic?

        - Wat moet de beoordeelde kennen en/of kunnen met betrekking tot deze competentie?

4. <u>De laatste check</u>

- Ontbreken er nog competenties voor de functie van ...?
    - Zo nee, ga door naar de volgende vraag.
    - Zo ja, welke competenties ontbreken er?
- Heeft u nog overige op- of aanmerkingen?
    - Zo ja, welke op- of aanmerkingen heeft u?

Ik wil u hartelijk danken voor uw medewerking aan dit onderzoek. De resultaten zullen binnen twee weken aan u worden voorgelegd.

E. Semi-structured interview protocol competence model (in Dutch) final

Ten eerste wil ik u bedanken voor uw medewerking aan dit onderzoek. Dit gesprek heeft als doel om de kennis en vaardigheden in kaart te brengen die benodigd zijn om de functie van ... binnen Grolsch naar behoren uit te oefenen. Dit gesprek zal ongeveer 45 minuten duren.

Allereerst zullen de topics worden besproken die behoren tot deze functie. Daarna komen de competenties ter sprake die gerelateerd zijn aan een van de topics. De topics en competenties zijn samengesteld op basis van de functiedocumenten binnen Grolsch.

Algemene vragen:

- Wat is uw naam?
- Wat is uw leeftijd?
- Wat is uw functie?
- Hoe lang bent u al werkzaam in deze functie?
- Wat is uw laatst afgeronde opleiding?

Topics per functie:

Topics Utility Technician
1. Operatie en procescontrole
2. Onderhoud van installaties en machines
3. Kwaliteitscontrole en analyses
4. Communicatie
5. Probleem oplossen
6. Continu verbeteren
7. Veiligheid en 5S

Topics Instrument Technician
1. Operationele ondersteuning
2. Gepland onderhoud
3. Routinematig onderhoud
4. Reparatie bij storingen/stilstand
5. Probleem oplossen
6. Veiligheid en 5S

Topics Mechanical Technician
1. Operationele ondersteuning
2. Gepland onderhoud
3. Routinematig onderhoud
4. Reparatie bij storingen/stilstand
5. Probleem oplossen
6. Veiligheid en 5S
7. Continu verbeteren

Topics Maintenance Planner
1. Schedulen van de onderhoudswerkzaamheden
2. Managen van de onderhoudssystemen
3. Onderhoudsplanning
4. Probleem oplossen

Topics Maintenance Controller
1. Optimaliseren en coördineren van het onderhoud
2. Controle van het onderhoud
3. Borgen dat de asset care integriteit en optimaal gebruik van een elektronisch management systeem
4. Leidinggeven aan het team

1. <u>Het bespreken van de topics</u>

- Zijn de desbetreffende topics het meest relevant voor het uitoefenen van deze functie?
    - Zo ja, ga door naar 2.
    - Zo nee,
        - Welk topic hoort er niet bij?
        - Welk topic ontbreekt er?

2. <u>Het bespreken van de verschillende competenties per topic</u>

- Is dit een competentie die toebehoort tot deze functie?
    - Zo ja, ga door naar de volgende vraag.
    - Zo nee, waarom niet?
- Is dit een competentie die toebehoort tot dit topic?
    - Zo ja, ga door naar de volgende vraag.
    - Zo nee, tot welk topic behoort deze competentie wel?
- Wat moet de beoordeelde kennen en/of kunnen met betrekking tot deze competentie?
- Ontbreken er competenties in dit topic?
    - Zo nee, ga door naar 3.
    - Zo ja,
        - Welke competentie ontbreekt er in dit topic?
        - Wat moet de beoordeelde kennen en/of kunnen met betrekking tot deze competentie?

3. <u>De laatste check</u>

- Ontbreken er nog topics en/of competenties voor deze functie?
    - Zo nee, ga door naar de volgende vraag.
    - Zo ja, welke topics en/of competenties ontbreken er?
- Heeft u nog overige op- of aanmerkingen?
    - Zo ja, welke op- of aanmerkingen heeft u?

Ik wil u hartelijk danken voor uw medewerking aan dit onderzoek. De resultaten zullen binnen twee weken aan u worden voorgelegd. De vervolgstap van dit onderzoek is het in kaart brengen van de beoordelingsmethode per competentie. Dit zal gebeuren door middel van een focus groep.

F. The functional and cognitive competences by function (technical functions)

Competences Utility Technician
Technical Skills Using machinery and equipment; *Knowledge of utility process*.
Operation and Process Control Operating according to quality norms and requirements (e.g. GMP-/HACCP-norm); Registration of waste; Conducting short stop checks; Analysing results of wastage registration and short stop checks; Problem-solving methods (i.e., Quick-fix routines, 5WHY and Root Cause Analysis (RCA)); Conducting a Fault Failure Analysis (FFA).
Maintenance of Installations and Equipment Cleaning of machinery and equipment; Conducting autonomous maintenance (included lubrication and inspection); Monitoring the technical condition and performance of plant and machinery; Troubleshooting for the benefit of utilities; Making maintenance plans; Making standard operating procedures (SOP's).
Quality Checks and Analyses Conducting quality checks; Conducting Critical Control Points (CCP) checks; *Knowledge of CCP's in production process*.
Communication Usage of GAP list (to register issues, problems and opportunities for improvement); Usage of communication media; Coordinating all activities performed by third parties to utility systems; *Knowledge of individual and team goals*.
Continuous Improvement Identifying trends and opportunities to reduce losses (using run/control charts, trend analyses, and other tools).
5S and Safety Carrying out household chores; Working according to the safety and 5S principles; Conducting safety measurements for ammonia, carbon dioxide, etc.; Writing out work permits to third parties; *Knowledge of WCM*.
Key to symbols: **Bold type** = Topic Regular type = Functional competence *Italic type* = Cognitive competence

Competences Instrument Technician (Brewing & Packaging)
Operation and Process Control Problem-solving methods (i.e., Quick-fix routines, 5WHY and Root Cause Analysis (RCA)); Conducting a Fault Failure Analysis (FFA); Conducting software modifications.
Maintenance of Installations and Equipment Conducting autonomous maintenance (included lubrication and inspection); Conducting administrative activities; Calibration of instrumentation; *Knowledge of priorities when rescheduling activities*.
Quality Checks and Analyses *Knowledge of CCP's in production process*.
Communication *Knowledge of individual and team goals*; *Knowledge of how to reschedule activities and unsolved problems*.
Continuous Improvement Monitoring line performances (specific for Instrument Technician Packaging); Monitoring installation performances (specific for Instrument Technician Brewing); Monitoring (dis)continue flows (specific for Instrument Technician Packaging); Making proposals to improve the continuity and performances.
5S and Safety Carrying out household chores; Working according to the safety and 5S principles; *Knowledge of WCM*.
Key to symbols: **Bold type** = Topic Regular type = Functional competence *Italic type* = Cognitive competence

Competences Mechanical Technician (Brewing & Packaging)
Technical Skills Using machinery and equipment (specific for Mechanical Technician Brewing).
Operation and Process Control Problem-solving methods (i.e., Quick-fix routines, 5WHY and Root Cause Analysis (RCA)); Conducting a Fault Failure Analysis (FFA).
Maintenance of Installations and Equipment Cleaning of machinery and equipment; Conducting autonomous maintenance (included lubrication and inspection); Making maintenance plans; Conducting administrative activities; *Knowledge of priorities when rescheduling activities*.
Quality Checks and Analyses *Knowledge of CCP's in production process*.
Communication *Knowledge of individual and team goals*; *Knowledge of how to reschedule activities and unsolved problems*.
Continuous Improvement Monitoring line performances (specific for Instrument Technician Packaging); Monitoring installation performances (specific for Instrument Technician Brewing); Monitoring (dis)continue flows (specific for Instrument Technician Packaging); Making proposals to improve the continuity and performances.
5S and Safety Carrying out household chores; Working according to the safety and 5S principles; *Knowledge of WCM*.
Key to symbols: **Bold type** = Topic Regular type = Functional competence *Italic type* = Cognitive competence

G. The functional and cognitive competences by function (maintenance functions)

Competences Maintenance Planner Packaging
Developing Preventive Maintenance Plans Reading and understanding equipment manuals; Maintenance scheduling (using the RCM methodology); Making maintenance task lists; Entering equipment information (in SAP).
Scheduling Maintenance Activities Creating overviews of open work orders.
Preparing Scheduled Maintenance Making capacity schedules; *Knowledge of priorities*.
Guaranteeing Availability of Materials and Services Making orders for components and external services; Booking components on order; Writing out work permits to third parties; *Knowledge of stocks*.
Coordinating Maintenance Implementing maintenance schedules.
Checking Performed Maintenance Make, modify and close notifications of maintenance needs (in SAP); Make, modify and close orders (in SAP); Making an order request for materials and services.
General Working according to the safety and 5S principles; *Knowledge of WCM*; *Knowledge of asset management strategy*.
Key to symbols: **Bold type** = Topic Regular type = Functional competence *Italic type* = Cognitive competence

Competences Maintenance Planner Brewing
Checking Performed Maintenance Reading and understanding equipment manuals; Maintenance scheduling (using the RCM methodology); Making maintenance task lists; Entering equipment information (in SAP); *Knowledge of production process*.
Scheduling Maintenance Activities Communicating maintenance schedules; Coordinating maintenance personnel planning; Verifying of routine maintenance activities; Creating overviews of open work orders.
Preparing Scheduled Maintenance Making capacity schedules; *Knowledge of priorities*.
Guaranteeing Availability of Materials and Services Making orders for components and external services; Booking components on order; Writing out work permits to third parties; Maintenance of master data; *Knowledge of stocks*.
Coordinating Maintenance Implementing maintenance schedules.
Checking Performed Maintenance Make, modify and close notifications of maintenance needs (in SAP); Make, modify and close orders (in SAP); Making an order request for materials and services; *Knowledge when to repair or to replace a component*.
Analysing Maintenance System Data Identifying frequent problems (in SAP).
Problem Solving and Continuous Improvement Problem-solving methods (i.e., Quick-fix routines, 5WHY and Root Cause Analysis (RCA)).
Ensuring Asset Care Integrity Ensuring asset care business processes.
General Working according to the safety and 5S principles; *Knowledge of WCM*; *Knowledge of asset management strategy.*
Key to symbols: **Bold type** = Topic Regular type = Functional competence *Italic type* = Cognitive competence

Competences Maintenance Controller Packaging
Developing Preventive Maintenance Plans Reading and understanding equipment manuals; Maintenance scheduling (using the RCM methodology); *Knowledge of production process*.
Scheduling Maintenance Activities Communicating maintenance schedules; Coordinating maintenance personnel planning; Verifying of routine maintenance activities.
Guaranteeing Availability of Materials and Services Making orders for components and external services; Booking components on order; Writing out work permits to third parties; *Knowledge of stocks*.
Checking Performed Maintenance Make, modify and close notifications of maintenance needs (in SAP); Make, modify and close orders (in SAP); Making an order request for materials and services; *Knowledge when to repair or to replace a component*.
Analysing Maintenance System Data Identifying frequent problems (in SAP).
Problem Solving and Continuous Improvement Problem-solving methods (i.e., Quick-fix routines, 5WHY and Root Cause Analysis (RCA)).
Ensuring Asset Care Integrity Ensuring asset care business processes; Knowledge of installation of equipment; *Knowledge of de-installation of equipment*.
General Working according to the safety and 5S principles; *Knowledge of WCM*; *Knowledge of asset management strategy*.
Key to symbols: **Bold type** = Topic Regular type = Functional competence *Italic type* = Cognitive competence

Competences Maintenance Controller Brewing
Developing Preventive Maintenance Plans Reading and understanding equipment manuals; Maintenance scheduling (using the RCM methodology); Making maintenance task lists; Entering equipment information (in SAP); *Knowledge of production process*.
Scheduling Maintenance Activities Creating overviews of open work orders.
Guaranteeing Availability of Materials and Services *Knowledge of stocks*.
Analysing Maintenance System Data Identifying frequent problems (in SAP).
General Working according to the safety and 5S principles; *Knowledge of WCM*; *Knowledge of asset management strategy*.
Key to symbols: **Bold type** = Topic Regular type = Functional competence *Italic type* = Cognitive competence