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IN SEARCH OF FM SERVICE REQUIREMENTS IN THE SUPPORT OF LABORATORIES

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ABSTRACT

The purpose of this research is to determine the requirements the facility services for the laboratories must meet in order to support laboratories in the best possible way. This is needed in order to obtain a fit between FM and the core business of the organisation. For determining this fit and the related service requirements, the FM added value as assessed by the users of comparable laboratories will be used as a proxy. Through a literature study and a case study research consisting of a questionnaire and semi-structured interviews data was gathered. After a Mann-Whitney test, PCA, and regression analyses, conclusions were drawn. Support services focused on samples are part of the core business of laboratories. Therefore it is considered as a risk if these tasks are not done by laboratory employees. Support services focused on laboratory supplies (including chemicals) and safety have the highest influence on the quality of facility services overall and contribution of facility services to the work in laboratories. These support services are therefore classified as core-close activities and it is beneficial for laboratories if these support services are well organised. It is a requirement that those support services are included in the service support offering, since the laboratory employees could not do their work without these services. Other support services with an influence on the quality of facility services overall and contribution of facility services to the work in laboratories, but with a clearly lower influence, are cleaning, laboratory glassware cleaning, managing laboratory gasses, building related maintenance, laboratory-process-related maintenance, and the laboratory specific access control. These support services are core-distinct activities. Alignment between FM and the laboratories is needed, in order to determine how the support services should be organised.

Key Word: Added value, Alignment, Facility Management, Laboratories, Requirements, Support services

EXECUTIVE SUMMARY

The Wageningen University and Research centre (Wageningen UR) Facility Management (FM) department is currently integrating the decentralized FM departments into the central FM department. Some of the decentralized FM departments have laboratories to support. The purpose of this research is to determine the requirements facility services for the laboratories must meet in order to support laboratories in the best possible way. This is needed in order to obtain a fit between FM and the core business of the organisation. For determining this fit and the related service requirements, the FM added value as assessed by the users of comparable laboratories will be used as a proxy. The objective formulated for this research was to *provide an evidence-based decision about what facility service requirements FM should meet in the support of laboratories in order to achieve a fit, by comparing the FM added value as assessed by users of comparable laboratories.*

According to the literature study the scope of FM activities is related to the physical workplace and mainly dependent on the core business of the organisation it supports. For the further detailing of the scope of FM there is not one answer, because the definition of FM is dependent on the development of the discipline within the organisation and the agreements made with the core business of the organisation. Traditionally, financial indicators were used to measure the 'contribution' of support services to the core business. Because of the focus shift from cost reduction to added value, different measurement methods are needed. FM added value is a trade-off between benefits, costs, and risks. This trade-off is made by the customer of the support service. Benefits are referring to the needs of the customer related to specific attributes of a support service. These benefits are weighed against the costs and any other sacrifices to be made by the customer. Thereafter, the potential risks should be determined. To be of added value for the core business of an organisation, FM should align with this core business. FM alignment is the coordination between the FM supply and the core business demand for support services in order to achieve a fit. To determine the best type of coordination for the alignment between FM and the departments within the organisation, there should be determined what activities an organisations core business has and what characteristics these activities have.

To get a broad picture of the research topic, it was envisioned to engage several organisations in the case study research with various research fields and from different industries. Ultimately, three peer organisations were found to compare with Wageningen UR. For this case study research, laboratory employees evaluated the FM added value of the different FM laboratory support services at the operational level using a questionnaire. Twenty independent variables were subtracted from fourteen support services. The questionnaire was send by e-mail, because of security reasons of some laboratories. The response rate of the questionnaire was 19.9% with a total of 238 respondents. The interviews in this research were used as extra validation of the results of the questionnaire. 23 semi-structured interviews were held at the tactical organisational level with facility managers and laboratory managers.

The results of this research showed that support services focused on samples are part of the core business, according to the laboratory employees. It is considered as a risk if these tasks are not done by laboratory employees. Support services focused on laboratory supplies (including chemicals) and safety had the highest influence on the quality of facility services overall and contribution of facility services to the work in laboratories. These support services are therefore classified as core-close activities and it is beneficial for laboratories if these support services are well organised. It is a requirement that those support services are included in the service support offering, since the laboratory employees could not do their work without these support services.

Other support services with an influence on the quality of facility services overall and contribution of facility services to the work in laboratories, but with a clearly lower influence, are cleaning, laboratory glassware cleaning, managing laboratory gasses, building related maintenance, laboratory-process-related maintenance, and the laboratory specific access control. These support services are core-distinct activities according to the outsourcing model of Arnold (2000). In order to support the laboratories in the best possible way, FM and laboratories should align the needs of the laboratories and the requirements of the services FM is offering, since various factors could affect the assessment of the support services (i.e. type of work done in the laboratories or type of organisation).

The current support service offering of Wageningen UR FM department for the laboratories was assessed as good. In order to support the laboratories even better in the future, it is recommended that the FM department does not make any concessions in terms of quality when it comes to managing chemicals, chemical waste, managing laboratory supplies, the swift intervention in the event of disruptions, and laboratory safety. This research showed differences between the included organisations when it comes to type of work done in the laboratories, time spent in the laboratories, and the way FM is organised in the organisations. Furthermore, the research showed statistically significant differences in the assessment of the different studied items. However, what causes these differences in assessment cannot be concluded with certainty. In order to optimise the service support of the Wageningen UR FM department for laboratories even more, research can be done focused on the different types of laboratories within the organisation. Most of the departments of Wageningen UR focus on scientific research. However, there are also some departments focused on analytical research. This research showed that different types of laboratories possibly have other service requirements. However, more research should be done to confirm this and also to be able to draw more comprehensive conclusions.

LIST OF ACRONYMS

FM	Facility Management
GMO	Genetically modified organisms
KMO	Kaiser-Meyer-Olkin
N/A	Not applicable
PCA	Principal component analysis
RQ	Research question
SLA	Service Level Agreement
Wageningen UR	Wageningen University & Research centre

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1. INTRODUCTION

The first chapter of this research report introduces the research topic. First the background of the research will be discussed (1.1). Thereafter the conceptual design of the research will be explained (1.2) including the research objective and the research questions. The third paragraph is focused on the research strategy (1.3). The last paragraph (1.4) gives an overview of the structure of this research report.

1.1 BACKGROUND INFORMATION

The Wageningen University and Research centre (Wageningen UR) Facility Management (FM) department is currently reorganising their organisation. Until recently, the central FM department delivered services up to the 'front door' of the buildings and managed the contracts that, according to legislation, should be tendered. These contain all contracts for services provided across the whole organisation, for example coffee, cleaning, and security. Small decentralized FM departments as part of educational and research units managed the other support services within the buildings, e.g. reception, indoor greenery, and default reporting and resolving. Since 2011, the decentralized FM departments are integrated stepwise into the central FM department, and hereby transformed in terms of organisational position. This integration means that the processes, services, and staff of the decentralized FM department will integrate into the central FM department. There are several reasons behind this integration, such as one integrated FM chain, standardization of the provided services, and a faster response to developments (De Haas, 2012).

Some of the decentralized FM departments have laboratories to support. There are different types of laboratories within the organisation. Wageningen UR has laboratories for animal research, plant research, environmental research, and food research. These specialized laboratories have their own specific support needs, but they also come with typical risks in performing support tasks on site. For example, in animal research it is necessary to arrange housing for the laboratory animals, which may imply certain risks of scratching and bites from the test animals if no precautions have been taken. Furthermore, in research laboratories situations could occur of which the risks are not yet (fully) known or difficult to evaluate (Zwaard, 2010). Because of these different types of research activities and possible corresponding needs and risks, different types of support services might be needed. The support services needed for these laboratories are somehow specialized and may require specific knowledge in terms of laws and regulations, guidelines, risk assessment and management, and building design. This all contributes to the complexity of the support situation that 'central FM' faces. At this moment, the support services for these laboratories are organized differently per decentralized FM department. At some locations the responsible educational and research units provide all the services needed. For other locations the decentralized FM department or the central FM department is providing (part of) the services. Within the central FM department, there is currently no specific knowledge and expertise available when it comes to supporting laboratories. This might be needed in order to support the laboratories in a proper way. Therefore, the question is how the centralized FM department should develop in terms of scope of their facilities services and competences of employees to be able to provide facility support to the Wageningen UR laboratories in such a way that it meets laboratory users' needs and complies with the special requirements that come from possible risks. To answer this question, the facility service support within Wageningen UR will be thoroughly investigated. However, it may be that there are other possibilities in terms of service support that are currently not present within Wageningen UR. Therefore we decided to examine several other laboratory organisations to determine how to support laboratories in the best possible way.

According to Chotipanich (2004), in managing facility resources, support services, and the working environment, FM needs to align with the core business in order to meet their objectives and support needs. However, according to literature (e.g. CEN, 2006) there is not one answer for every organisation for this alignment issue. Every organisation is unique and has its own characteristics. As a consequence the position, role, scope, and priorities of the FM services are likely to vary per organisation in order to align with the support needs of the core business of the organisation (Chotipanich, 2004). Therefore, to do so, it is important to first determine which services need to be within the scope of FM within a specific organisation and the requirements these services should meet. Patanapiradej (2006) takes this a step further by stating that successful FM is about supporting workplaces while adding value to the processes. The above mentioned alignment also has a role in the added value of FM. Kok *et al.* (2011) and Jensen *et al.* (2010) state that alignment between the core business of an organisation and FM is a key element to achieve FM added value.

Jensen *et al*. (2008) found a change in the perspective of the FM discipline from mostly focusing on cost reduction towards the need to focus on adding value, both for in-house FM organisations and external FM providers. Consequently, there is also the need to increase the competences and knowledge within the FM discipline towards adding value (Jensen *et al*., 2008). In order to reduce costs, FM can rely on experiences from the past and management tools that were developed with a cost reduction focus. If FM wants to provide added value, the knowledge and competences must develop and be more specific to the core business FM supports (Jensen, 2010-a).

Because of the integration process which is currently in progress within the Wageningen UR FM department, the alignment between FM and the core business must also be renewed. Former support service agreements between decentralized FM departments and educational and research units expire and new support service offerings should be formed between the central FM department and educational and research units. Here, alignment is an important element. Alignment is about the balance of the collaboration between organisational components and between the environment and the organisation. It creates harmony between strategy and plans within the organisation (Griffith and Myers, 2004). If there is no alignment between FM and the core business, it might be possible that not all necessary support services are provided to the core business. It might also be the case that redundant services are in the support service offering and/or with the wrong specifications, which cost money but have no value for the core business. Therefore, this alignment is necessary to provide a good service support offering to the core business. If there is alignment between organisational components, this is called a fit, which can be expressed in terms of FM added value (Kok, 2012). But when is there alignment and corresponding fit between the core business of an organisation and FM?

There is a lively discussion in the scientific literature about added value. Added value is a subjective term that is related to an individual's perception (Bowman and Ambrosini, 2000; Lepak *et al.*, 2007; Zeithaml, 1988). Added value is also a trade-off between benefits ('get' component) and costs ('give' component) (Ravald and Grönroos, 1996; Williams, 1996; Zeithaml, 1988). To this trade-off between benefits and costs, Kok *et al.* (2011) also add potential risks. Because added value is an individual and therefore subjective assessment, perceptions may differ on the outcome of this trade-off (Lepak *et al.*, 2007). This also applies to the various organisational levels. According to Kok *et al.* (2011) "because the facility manager is faced with different organisational levels in the process, also differences in perception may arise with regard to the added value of FM." These differences in perception arise because there are differences in knowledge, goals, and context conditions between the employees working on the different organisational levels. This affects the judgement of added value (Lepak *et al.*, 2007). Therefore it is difficult to determine whether services meet the customer requirements and provide added value (Lehtonen, 2006; Van Ree and McLennan, 2006). This has two

consequences for FM as a discipline. First of all, FM must focus on aligning the services they provide with the needs of the core business. As mentioned before, FM must create a 'fit' between core business and FM (Jensen, 2011). FM must create this fit on all three organisational levels – strategic, tactical, and operational – to provide added value for the whole organisation (Patanapiradej, 2006). Secondly, due to the shift to added value new methods of measurement are needed to be able to determine whether there is a fit in terms of FM added value and deviate from only using financial indicators that were, according to Pitt and Tucker (2008), traditionally being used to make services measurable.

Due to the current integration process, the central FM department of Wageningen UR will provide services to the laboratories in the near future. The purpose of this research is to determine the requirements facility services for the laboratories must meet in order to support laboratories in the best possible way. This is needed in order to obtain a fit between FM and the core business of the organisation. For determining this fit and the related service requirements, the FM added value as assessed by the users of comparable laboratories will be used as a proxy.

1.2 CONCEPTUAL DESIGN

This paragraph describes the conceptual design of the research. According to Verschuren and Doorewaard (2010) "the conceptual design determines *what, why and how much* is going to be studied within this research." The conceptual design consists of the research objective (1.2.1), the research framework (1.2.2), the research questions (1.2.3), and the definitions and operationalizing of key concepts (1.2.4).

1.2.1 RESEARCH OBJECTIVE

The research objective defines the fundamental aim and purpose of the research; it represents the direction of the research, which is obtained from the introduction (Verschuren and Doorewaard, 2010).

This research focused on the alignment problem between laboratories and FM departments regarding the facility service requirements the FM department must meet in order to support the laboratories in the best possible way. Within this alignment problem the aspect FM added value plays a key role. This research analysed this alignment problem with the following objective:

To provide an evidence-based decision about what facility service requirements FM should meet in the support of the laboratories in order to achieve a fit, by comparing the FM added value as assessed by users of comparable laboratories.

1.2.2 RESEARCH FRAMEWORK

A research framework is a schematic representation of the research objective and includes the appropriate steps that need to be taken in order to achieve this research objective (Verschuren and Doorewaard, 2010). With the previously formulated research objective in mind, the research framework for this research was developed (Appendix I). In this research framework a distinction has been made between the theoretical review, the empirical study, and the conclusion. These will also be performed stepwise in this chronological order.

The first column of the research framework is the theoretical review. In this research the theoretical review focused on 'Scope of FM', 'Characteristics laboratory support', 'FM Added value', and 'Alignment/Fit'. The outcome of the theoretical review provides the input for the design of the empirical research, the second column of the research framework. The empirical research exists of an in-depth investigation within laboratories organisations. The structure of this empirical study will be explained in paragraph 1.3 'Technical design'. After analysing the results, the outcome of the empirical study was used to write the conclusion and recommendations, the last column of the research framework.

1.2.3 RESEARCH QUESTIONS

The objective from paragraph 1.2.1 and the research framework shown in Appendix I were used to formulate the questions for this research. According to Verschuren and Doorewaard (2010) this set of questions consists of a number of core questions and sub-questions that need to be answered during the different phases of the research. The answers to the research questions provide the exact knowledge required in order to achieve the research objective. For this research there is one general research question and six sub research questions (RQ).

The general research question of this research is:

> What facility service requirements should FM meet in the support of laboratories aiming to achieve FM added value and how should FM and laboratories best align to meet these requirements?

To answer the general research question several research questions (RQ) were formulated. There were four RQ's formulated for the theoretical review:

RQ1:   What services could be considered within the scope of FM?

RQ2:   What is characteristic to supporting laboratories in terms of scope of facility services and additional requirements of the FM organisation?

RQ3:   How can 'FM added value' for the core business be determined?

RQ4:   What is indicative for the alignment between the core business and FM?

For the empirical study two RQ's were formulated:

RQ5:   How are the different support services, which are comparably delivered to laboratories, evaluated in terms of their FM added value?

RQ6:   What is indicative for the differences in FM added value of laboratory support services within comparable laboratories?

1.2.4 DEFINITION OF CONCEPTS

This paragraph of the conceptual design defines the core concepts of the research objective and the research questions (Verschuren and Doorewaard, 2010).

Alignment:
FM alignment concerns the coordination between FM and demand (Kok, 2012).

Core business:
The core business of an organisation includes all activities which are necessarily connected with a company's existence (Arnold, 2000).

FM added value:
FM added value is the customer perceived contribution of the different facility services to the organisation in terms of benefits in comparison to costs and risks (Kok *et al.*, 2011).

Scope:
The scope of FM is the range of services, activities, responsibilities, skills and knowledge of facility management, all intended to better integrate existing organisational factors (Patanapriadej, 2006).

1.3 RESEARCH STRATEGY

The chosen research strategy determines how the needed data is gathered in the research. This research started with a desk research, which is according to Verschuren and Doorewaard (2010) carried out mainly from behind a desk. This part of the research focused on finding existing literature produced by others combined with a reflection on this existing literature (Verschuren and Doorewaard, 2010). This review of the existing literature is essential in order to acquaint with the available knowledge in the research area (Kumar, 2005). For this research the desk research focused on four topics, namely 'Scope of FM', 'Characteristics laboratory support', 'FM Added value', and 'Alignment/Fit'. These four topics correspond with the first four research questions formulated in paragraph 1.2.3.

The second part of the research is the empirical research, which consisted of a case study research within laboratory organisations. Verschuren and Doorewaard (2010) describe a case study research as a research strategy in which the researcher tries to gain a profound and full insight into one or several objects or processes that are confined in time and space. There are several variants for doing a case study research; for this research the comparative case study was selected. Within a comparative case study, several comparable cases are investigated (Verschuren and Doorewaard, 2010). These cases, the peer organisations, were studied to gain more information and a better understanding of the opportunities for FM in supporting laboratories. Data was collected by doing interviews with the facility managers and laboratory managers and by doing a questionnaire at the operational organisation level.

1.4 OUTLINE RESEARCH

The next three chapters of this research report focus on answering the literature study research questions. The scope of FM and the characteristics of the support services for laboratories are discussed in chapter two. Subsequently FM added value is discussed by answering RQ3 in chapter three. The literature study is completed with answering RQ4 focused on alignment in chapter four. Then, in chapter five, will be explained how the data was collected for the empirical part of this research. The results of the empirical study are discussed in detail in chapter six. Where after, in chapter seven the conclusion, discussion, and recommendations are described.

2. THE SCOPE OF FACILITY MANAGEMENT

Facility Management (FM) is a relatively new discipline that has developed strongly in the past twenty years. Because of the development of this discipline, the definition and scope of FM also changed rapidly. To get more clarity about the scope of FM, the first part of this chapter will answer RQ1: *"What services could be considered within the scope of FM?"*

Thereafter, a closer look will be taken into the support services for laboratories. Support services for laboratories are specialized and may require specific knowledge in terms of laws and regulations, guidelines, risk assessment and management, and building design. Because of this specific knowledge, it is important to have a better understanding of the uniqueness of laboratories and needed support services. Therefore, the second part of this chapter tries to specify this uniqueness by answering RQ2: *"What is characteristic to supporting laboratories in terms of scope of facility services and additional requirements of the FM organisation?"*

This chapter starts with an overview of the development within the FM discipline by providing a table with several definitions of FM from the past twenty years (2.1). Thereafter the similarities and ambiguities in these definitions are discussed (2.2). In addition, a glance at the future of FM will be given (2.3). Then the specific characteristics of laboratories and related support services are discussed (2.4). The chapter will conclude with an answer to RQ1 and RQ2 (2.5).

2.1 DEVELOPMENT OF THE FM DISCIPLINE

According to De Toni and Nonino (2009) FM as a professional discipline was born at the end of the seventies in the United States. The discipline became a managerial practice in Europe in the eighties. The start of FM in Europe was in the United Kingdom and thereafter it spread to other countries on the continent (De Toni and Nonino, 2009). Traditionally, auxiliary service management was associated with the term FM. De Toni and Nonino (2009) stated that "this included a large number of services, such as reception, cleaning, security, catering, internal logistics, mailing, space, and document management." The past ten years FM grew rapidly and became a robust service sector (McLennan, 2004). The discipline has increased the scope of the offered services and became a more interdisciplinary practice. Because of this increasing scope, misunderstandings arise about the definition of FM (De Toni and Nonino, 2009). Table 1 shows several different definitions of FM. As comes clearly out of the overview, old and newer definitions provide clarity on the part of FM which has not changed over the years. Due to the extension of the discipline, the current scope of FM is somewhat vague. Next paragraph (2.2) will give an explanation on the similarities and ambiguities between the definitions in Table 1.

Author	Definition of FM
Cotts & Lee (1992)	"FM is the practice of coordinating the physical workplace with the people and work of the organization; it integrates the principles of business administration, architecture, and the behavioral and engineering sciences."
Then (1999)	"The practice of FM is concerned with the delivery of the enabling workplace environment - the optimum functional space that supports the business processes and human resources."
Tay & Ooi (2001)	"The integrated management of the workplace to enhance the performance of the organisation."
Nutt (2000)	"The primary function of FM is resource management, at strategic and operational levels of support. The generic types of resource that are central to the FM function; the management of financial resources, human resources, physical resources, and the management of the resources of information and knowledge."

Okoroh *et al.* (2001)	"FM deals with the management of the service interface between the core and the non-core services, paying special attention to the third way stakeholders (end-user views, service consumers, politicians, unions and environmentalists)."
Chotipanich (2004)	"Facility management can be intended as the function that coordinates and integrates the physical resources as well as the working space and offers the services supporting the core business to the organization staff and process."
CEN (2006)	"The integration of processes within an organization to maintain and develop the services which support and improve the effectiveness of its primary activities."
Patanapiradej (2006)	"FM is the multi-disciplinary kind of work that covers a wide range of various activities, responsibilities and knowledge. Moreover every aspect of an organisation seems to be drawn into FM."
De Toni & Nonino (2009)	"Facility management is a multidisciplinary approach for designing, planning and managing the non-core services in an integrated and coordinated way; these services - linked particularly to real estate - support the strategic core activities and are essential for the effective and efficient functioning of an organization."

Table 1: FM definitions

2.2 SIMILARITIES AND AMBIGUITIES IN DEFINING FM

2.2.1 FOCUS OF FM

From the definitions above it can be concluded that over the years the focus of FM remained the same, namely supporting the workplace. According to Tay and Ooi (2001) and Connors (2003) "the workplace in this instance refers to a place where work (of any nature) is carried out. Thus, it is not limited to commercial office buildings but also includes other types of workplaces such as medical, education and industrial workplaces." To be more specific, this is the physical workplace with related support services (Lehtonen, 2006; Lehtonen and Salonen, 2006). Since FM is focused on the workplace, it can also be said that FM can be used in any type of organisation, because all organisations need a workplace for their businesses (Tay and Ooi, 2001).

Another common theme in the definitions in Table 1 is that FM should play a supporting role in the performance of an organisation and should have an integrated approach while supporting an organisation (Tay and Ooi, 2001; Connors, 2003). In other words, FM has a single focus on the workplace, but in order to support this workplace FM should have a multi-faceted approach (Tay and Ooi, 2001).

In the literature, there is consensus about several services for which FM is responsible in supporting the workplace. These services can be divided into three groups (De Toni and Nonino, 2009). The first group is the 'people-related services' (reception, catering, cleaning, mail distribution, and internal logistics) and is defined as employee service management (Chotipanich; 2004; De Toni and Nonino, 2009; McLennan, 2004; Okoroh *et al.*, 2001; Patanapiradej, 2006). The second group is the 'building-related services' (building design, maintenance, security, and greenery), which is defined as building management (Chotipanich; 2004; De Toni and Nonino, 2009; McLennan, 2004; Okoroh *et al.*, 2001; Patanapiradej, 2006). And the third and last group is the 'space-related services' (office layout, office furnishing, office equipment, office activity supporting, and space allocation) that is defined as space management (Chotipanich; 2004; De Toni and Nonino, 2009; McLennan, 2004; Okoroh *et al.*, 2001; Patanapiradej, 2006).

In addition to this clear focus of FM, the definitions in Table 1 also show a commonality in the distinction made between core business and the support of this core business; the non-core business. Other authors, not included in the table, support this point of view by stating that FM is a facilitating function in managing facility resources, support services, and working environment. This facilitating function should fit with the objectives and activities of the core business in order to support this core business in the short- and long-term (Barrett, 2000; Chotipanich, 2004). According to De Toni and Nonino (2009) the term non-core refers to "the organization processes that marginally contribute to accomplish company goals, but are however necessary for the organization functioning; in fact without these activities organizations would not be able to operate." Whereas core activities are those activities by which an organisation offers a unique value to its customers (McIvor *et al.*, 1997; Nellore and Söderquist, 2000). This distinction between the core business and non-core business emphasizes the fact that FM is a non-core focused discipline that only makes sense when it supports the core business of an organisation (Barrett, 2000). Kok *et al.* (2011) state that "it can be argued that facility support for organisations is based on a collection of more or less specialised technical and service-related tasks which are not part of the primary process, but which are essential for the functioning of this primary process." This primary process or core business of an organisation is important for identifying the scope of facility management. What the core business is, what the core activities are, and how these activities could be supported must be identified. However, this is easier said than done. Identifying the core activities of an organisation is a comprehensive process involving many and foremost difficult questions to be answered. This might give difficulties and thus the determination of the scope of FM could also be tricky (Javidan, 1998; McIvor *et al.*, 1997; Venkatesan, 1992). Chotipanich (2004) indicates this by stating that "the function, role and responsibility of FM tend to differ in different organisations and circumstances. Selecting an appropriate role of FM for the given organisation and circumstance is crucial." Besides, the organisational priorities might shift over time or the business circumstances change which requires an adjustment of the support environment (Chotipanich and Nutt, 2008). This makes the definition of the scope of FM more complicated, since there is not one single solution to fit all the circumstances - even when it comes to organisations in the same sector, country, culture or location (Chotipanich and Nutt, 2008).

Porter (1985) was the first one to make the differentiation between the primary process and the support activities of an organisation by presenting the theory of the value chain. According to Jensen (2011) this theory "is also seen as the basis for the development of the concept of FM as a function supporting a company's core business." Within this theory, Porter makes the distinction between the primary process of the organisation and the supporting services needed to execute the primary process (Porter, 1985). This separation is shown below in Figure 1 on the next page.

The primary activities are the activities that are directly related with the creation or delivery of a product or service (Porter, 1985). In Figure 1 these activities are respectively inbound logistics, operations, outbound logistics, marketing and sales, and services. Each of these primary activities are connected with the support activities. These support activities help to improve the effectiveness and efficiency of the primary activities (Jensen, 2011; Porter, 1985). As shown in Figure 1 the support activities are firm infrastructure, human resource management, technology development, and procurement.
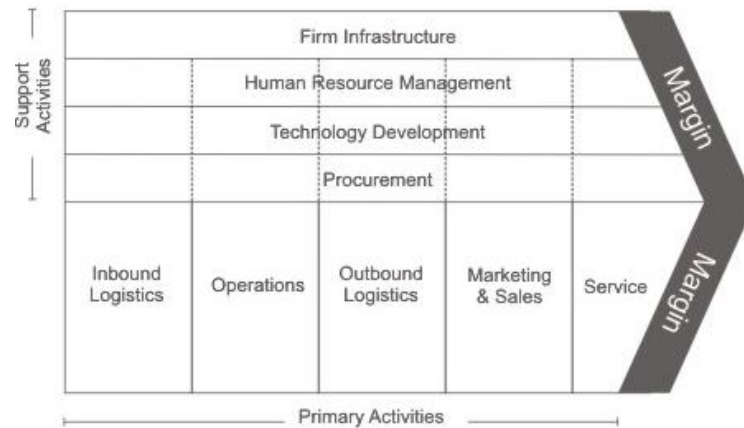
Figure 1: Porter's Value Chain (Porter, 1985)

Though Porter's (1985) value chain does not mention FM, the FM discipline is covered by several support activities in his model, e.g.:

- *'Procurement'* as one of the support activities includes procurement of raw materials, energy, laboratory equipment, office equipment, and buildings. These are all components of the FM discipline (Jensen, 2011).
- *'Firm infrastructure'* is for instance planning, finance and relations to authorities (Jensen, 2011; Porter, 1985). The support activities within this group support the entire organisation and not a specific department or activity of the organisation (Porter, 1985). This is also characteristic for the FM discipline.

2.2.3 ORGANISATION LEVEL OF FM

Besides the similarities in the FM definitions in Table 1, an important contradiction about the scope of FM can be found. This contradiction is about defining the organisational level on which FM operates. According to Nutt (2000) and Patanapiradej (2006) FM has a role on both the strategic and operational level of an organisation. However, De Toni and Nonino (2009) only mention the strategic organisation level in their definition. Others do not mention the organisational level FM operates on at all. Conners (2003) argues that by focussing on the non-core activities, FM has clearly chosen for a non-strategic organisation level focus. Though, the FM discipline has some responsibility when it comes to the strategic organisation level (Conners, 2003). This clearly indicates the expanding of the scope of FM over the years. In the nineties the scientific literature does not mention the organisational levels FM operates on. At the beginning of the twenty-first century, the discussion on this topic was launched. Present FM is focused on all three organisational levels. Jensen (2008) summarizes this by stating that FM is originally an operational discipline, but has become more important over the years on tactical and strategic organisational level.

CEN (2006) has summarized this in the FM model (see Figure 2 on the next page). The figure shows a model that provides a framework for describing the way FM supports the different organisational levels of the core business of an organisation. The model is based on general models for business processes, including primary business processes and support services. The relationships between supply and demand are displayed and the various levels of possible interaction between the core business and FM are shown. To deliver the required results, FM should be aligned with the mission, vision, and goals of the parent organisation. Therefore FM participates on the main levels of the organisation, namely; strategic, tactical, and operational (CEN; 2006).
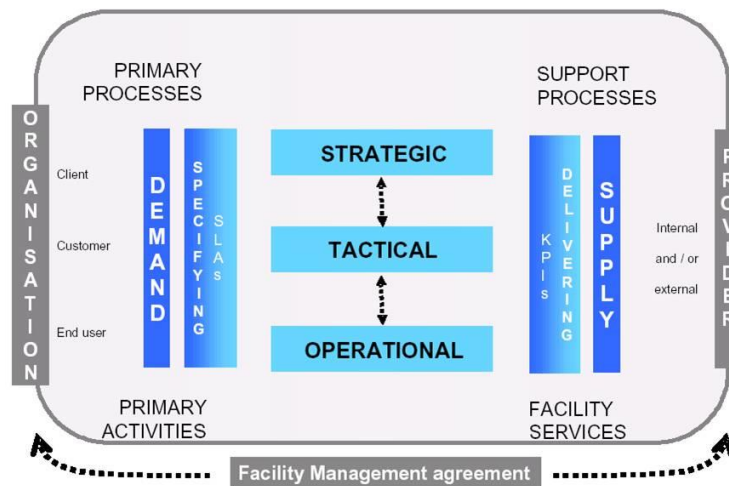
Figure 2: Facility Management Model (CEN, 2006)

From the table with definitions (Table 1) uncertainty arose about the organisational level focus of the FM discipline. Despite this uncertainty it can be said that nowadays FM operates on all three organisation levels (CEN, 2006; Chotipanich, 2004; Jensen, 2008; Jensen *et al.*, 2010, Jensen *et al.*, 2012; Patanapiradej, 2006).

2.2.4 CONCLUSION

FM is a relatively new discipline that has developed strongly in the past twenty years. Because of this development, the scope of FM is also subject to change. However, several definitions show that the focus of FM has remained the same over the years; namely the support of the physical workplace. A multi-faceted approach is used in this support with a focus on people-related services, building-related services, and space-related services. Together with this multi-faceted approach, alignment with the core business is important. On the other hand, the definitions show contradictions concerning the organisational level FM operates on. Originally FM was an operational discipline, but over the years FM has grown and nowadays FM is active on all three levels of an organisation.

2.3 FUTURE SCOPE OF FM

Several researchers agree that FM is a broad area of expertise, responsible for a wide field of services that support the core business of an organisation (Amaratunga *et al.*, 2000; CEN, 2006; Patanapiradej, 2006). FM supports the core business of an organisation in being productive and fulfils the organisation's objectives. In order to do so in the future, FM needs to redesign its strategies and regimes in a new direction (Patanapiradej, 2006). Important for the scope of FM in the future is the shift from a focus on cost reduction to a focus on added value (Jensen *et al.*, 2008). As previously indicated, FM was originally an operational discipline (Jensen, 2008). In the eighties and nineties, the development of the discipline was mainly driven by cost reduction (Jensen *et al.*, 2012-b; Coenen *et al.*, 2012-b; Sarasoja, and Aaltonen, 2012). In order to survive and compete in the changing business environment, organisations had to be focused on cost savings, meaning that FM as supporting service provider had to reduce their costs as well (Connors, 2003). Around the turn of the century, in the years of growing demand, cost reduction was no longer enough for survival in the business environment. FM also had to provide attractive workplaces including support services in order to attract employees. This shifted the focus from cost reduction to the added value of FM as a discipline (Jensen *et al.*, 2012-b; Jensen and Katchamart, 2012). The financial crisis, which started in 2008, has brought the focus back to cost savings, but that will only be temporary (Jensen *et al.*, 2012-b). There is no doubt that the FM discipline must focus on added value. This requires other knowledge and

competences specific to the field in which FM operates. In order to reduce costs, FM can rely on experiences from the past and management tools developed in order to reduce costs. However, if FM wants to provide added value, new knowledge and competences must be developed, specified on the core business FM supports (Jensen, 2010-a).

2.4 CHARACTERISTIC TO SUPPORTING LABORATORIES

Support services for laboratories are specialized and require specific knowledge in terms of laws and regulations, guidelines, risk assessment and management, and building design. Because of this specific knowledge, it is important to have a better understanding of the uniqueness of laboratories and needed support services. So it is necessary to determine what a laboratory is and what unique services are needed in a laboratory. The term 'laboratory' includes a wide variety of organisations, workplaces, and buildings. Thereby, a distinction can be made in the nature of the work (such as scientific research, routine analysis, or quality checks), the material used during the work (chemical, biological, or physical agents), and the organisation where the laboratory is part of (for instance educational institutions, governmental services, hospitals, or the industry). The most important similarities between all these types of laboratories are the measurements and experimental studies that are carried out, in which biological and physical agents and other research materials are involved (Zwaard, 2010).From this description can be concluded that different types of laboratories (i.e. educational institutions, governmental services, hospitals, or the industry) have different primary purposes. For instance, educational institutions have a primary goal to conduct basic research and teach students. A research institute, however, has as main objective to carry out applied research. And a pharmaceutical company has a primary objective to preserve the long-term profitability (Omta *et al.*, 1993; Omta *et al.*, 1997).

For this research the following definition of the term laboratory will be used:
"A laboratory is a physical workplace where scientific research, routine analysis, or quality checks are performed by doing measurements and experimental studies, whereby chemicals, biological, or physical agents are used during the work."

RQ2 focuses on specifying the characteristics of support services for laboratories in terms of scope and requirements of FM. However, in the literature there are only a few investigations found that focus on FM and support services for laboratories. These researches often focus on a specific part of laboratories and related support services or trends in laboratory work, not on the total FM support service offering for laboratories and accompanying requirements. For instance Baumans and Van Loo (2012) investigated the impact of housing systems on laboratory animals. According to their research, providing suitable housing systems for laboratories where laboratory animals are used during the research is an important support service for the core business. The literature also focuses on coordination, both within a laboratory and between laboratories. Here coordination involves the use of staff and equipment (El-Nageh, 1996). This has to do with the current trends in laboratories, which, according to Unwin *et al.* (2008), indicate that research laboratories have become more team-focused, multidisciplinary research environments, and require flexible laboratory configurations.

Because these specific laboratory support services with corresponding requirements are important for the remainder of this research, we decided to use documents from the commissioning organisation Wageningen UR. These documents are presented in appendix II and III. The support services listed in these documents are assessed according to laboratory focus. Support services which do not affect the work in the laboratories, such as catering, were excluded from this research. Subsequently, the two lists are merged into one list of laboratory support services that will be used in this research, as shown below in Table 2. This list of laboratory support services was evaluated by several specialists in the field of support services for laboratories.

Laboratory support service	Explanation
Sample reception & administration	This support service focuses on receiving and registering samples in the central system of the institute. This will prevent monsters from being interchanged or get lost.
Track & trace	This support service focuses on tracking and tracing the sample material from entry to destruction. The storage conditions, -locations and retention periods of original, duplicate and counter samples are monitored and recorded. Also, the (sequence of) actions during the production of sub-samples is recorded. These sub-samples are transferred from sample preparation to the laboratories; this is also recorded.
Sample storage	The sample storage consists of storing samples, both for the short and long term, under prescribed conditions (i.e. temperature and humidity) for example in freezer, fridge or at room-temperature.
Sample preparation	Sample preparation is about preparing the received samples in such a way that the laboratory staff can perform the required analysis (includes actions such as grinding, milling, freeze-drying, and production of homogeneous (sub) samples).
Temperature-registration	The temperature of all the refrigerators, freezers, coolers, and (breeding) stoves is continuously monitored. If any of the connected devices is outside its specifications, the device-manager is warned (or overnight the emergency repair employee) by phone. This prevents valuable (sample) material from getting lost and there is monitored that the sample storage, the storage of used reagents, and the analyses have occurred under the prescribed temperature conditions.
Laboratory specific access control	The controlled access to laboratories and restricted access to specific facilities (such as storage rooms, specific laboratories, etc.), including the central distribution of access-cards and central application for registration.
Building-related maintenance	This overall support service includes sub-services that are important for laboratories, such as climate control (heating, cooling, and air-humidification) and the stand-by generator.
Laboratory-process-related maintenance	Maintenance related to specific laboratory equipment, such as fume cupboards, safety storage cabinets, the system for technical gasses, and compressed air.
Cleaning	The regular cleaning of laboratories, taking the special requirements from the laboratories into account, such as the presence of laboratory personnel during the cleaning and vaccinating the cleaning staff.
Laboratory glassware cleaning	This support service is for collecting, cleaning (wash and dry or stove), and returning (to the same laboratory) of laboratory glassware.
Managing laboratory supplies	The management of the laboratory supplies consists of ordering, receiving, storing, stocking, and distribution of (some) laboratory supplies.
Managing chemicals	This support services consists of receiving, checking, logging, and if required the temporary storage of chemicals.

Managing laboratory gasses	A support services for receiving, storage, and distribution of laboratory gasses, such as oxygen, argon, helium, carbon-dioxide, nitrogen, and liquid nitrogen.
Chemical waste	The waste support service is the central collection, categorization, storage, and offering to waste processors of chemical waste (different waste streams) by the facilities management department conform to the relevant guidelines and procedures.

Table 2: Laboratory support service (De Vries; 2012; Maas, 2013)

From Table 2 can be concluded that the specific laboratory support services and related requirements are focused on the handling, storage, and processing of samples and other special materials.

2.4.1 CONCLUSION

Laboratories might belong to different types of organisations (for instance educational institutions, governmental services, hospitals, or the industry) where different types of work are done (such as scientific research, routine analysis, or quality checks). However, all laboratories have in common that they carry out measurements and experimental studies, in which biological and physical agents and other research materials are involved. In the literature, little can be found about facility support services for laboratories. Often the studies are focused only on one part of a laboratory, such as housing systems for laboratory animals, or the coordination of staff and equipment between or within laboratories. Since specific laboratory support services with corresponding requirements are important for the remainder of this research, we decided to use documents from the commissioning organisation Wageningen UR to create a list of possible support services for laboratories. These services are sample reception and administration, track and trace, sample storage, sample preparation, temperature-registration, laboratory specific access control, building-related maintenance, laboratory-process-related maintenance, cleaning, laboratory glassware cleaning, managing laboratory supplies, managing chemicals, managing laboratory gasses, and chemical waste.

2.5 CONCLUSION

Summarizing, the literature on the scope of FM agrees on a number of issues concerning the definition and scope of FM. First of all, there can be concluded that FM is a discipline that focuses on the physical workplace and can be used in every type of organisation. The goal of FM is to support the performance of the organisation by using an integrated approach and align with the core business. Because of the importance of this core business and the differences in core business between organisations, the scope of the FM activities varies per organisation. Literature shows inconsistencies when it comes to the organisation level where FM operates on. FM was originally an operational discipline, but over the years it has become more important for the tactical and strategic organisational levels. So nowadays FM operates on all three organisational levels. With regard to the future, the FM discipline, and thereby the scope of FM, is still in development. The future focus will be on the added value that FM can provide for the core business.

Based on the literature study in this chapter the following answer to the first research question of this research was given (RQ1: *What services could be considered within the scope of FM?*); the scope of FM activities is related to the physical workplace and mainly dependent on the core business of the organisation it supports. In the literature, there is consensus about several services for which FM is responsible in supporting the workplace, namely; the people-related services (reception, catering,

cleaning, mail distribution, and internal logistics), the building-related services (building design, maintenance, security, greenery), and the space-related services (office layout, office furnishing, office equipment, office activity supporting, and space allocation). For the further detailing of the scope of FM there is not one answer, because the definition of FM is dependent on the development of the discipline within the organisation and the agreements made with the core business of the organisation.

This chapter also tried to answer RQ2 (*What is characteristic to supporting laboratories in terms of scope of facility services and additional requirements of the FM organisation?*). Unfortunately there was too little literature found to answer this question. Since the answer to this research question is important input for the remainder of this research, it was decided to use information from the commissioning organisation in order to be able to answer this question. From these documents (see appendix II and III) fourteen specific laboratory support services were picked, namely; sample reception and administration, track and trace, sample storage, sample preparation, temperature-registration, laboratory specific access control, building-related maintenance, laboratory-process-related maintenance, cleaning, laboratory glassware cleaning, managing laboratory supplies, managing chemicals, managing laboratory gasses, and chemical waste. The required knowledge and competences FM needs for these support services are focused on the handling, storage, and processing of samples and other special materials.

3. DETERMINING FM ADDED VALUE

Within the Facility Management (FM) discipline there is a shift in focus from cost reduction towards adding value. For this research it is important to identify what FM added value exactly is and how it can be determined. This measurability of FM added value is required for the empirical part of this research. Therefore, this chapter will focus on FM added value by answering RQ3: *How can 'FM added value' for the core business be determined?*

This chapter will start with defining the concept FM added value (3.1). Thereafter the measurement of FM added value is discussed (3.2). The chapter will conclude with an answer to RQ3 (3.3).

3.1 DEFINING FM ADDED VALUE

The term 'value' is widely used in literature, particularly by classical economics (Jensen *et al.*, 2012-a). Value is a trade-off made by the customer between price and quality of a product or service. However, scholars are increasingly suggesting that value is more than this price-quality trade-off (Kumar and Grisaffe, 2004). More often 'added value' is mentioned in various contexts in literature, (Jensen *et al.*, 2012-b; Woodruff, 1997; Zeithaml, 1988). For example added value has been used in several different disciplines, such as management, marketing, and product development (Jensen *et al.*, 2012-b; Woodruff, 1997). Because added value is used in different contexts, various descriptions were also found in the literature (Jensen, 2010-b; Jensen *et al.*, 2012-b; Jensen and Katchamart, 2012; Zeithaml, 1988). Even though there is a variety in the use of the concept, the literature agrees on several aspects of added value. First of all, added value is an individual assessment; it is the opinion of the individual needs of a customer about a product or service that determine the added value (Coenen *et al.*, 2012-a; Jensen *et al.*, 2012-a; Von Felten *et al.*, 2012; Waldburger and Nielsen, 2012; Zeithaml, 1988). Therefore, added value is subjective (Jensen *et al.*, 2012-a; Von Felten *et al.*, 2012). It is something which is perceived by the customer. It is not determined objectively by the provider (Coenen *et al.*, 2012-a; Woodruff, 1997). Added value is the assessment of the customer and is based on observations of what the customer received (the 'get' component) in terms of benefits and what is given (the 'give' component), which refers to the price that has to be paid or other sacrifices that have to be made (Coenen *et al.*, 2012-a; Kumar and Grisaffe, 2004; Menon *et al.*, 2005; Zeithaml, 1988). These 'get' and 'give' components are known as the trade-off between benefits and sacrifices (Woodruff, 1997).

Focussing on added value within the FM discipline, a clear definition of FM added value is given by Kok *et al.* (2011). They state that FM added value is "the customer perceived contribution of the different facility services to the organisation in terms of benefits in comparison to costs and risks." To this definition they add that the observed added value is connected to a specific situation wherein a product or service is offered, i.e. it is context dependent (Jensen *et al.*, 2012-a; Kok *et al.*, 2011). Besides this, added value is also dynamic (Kok *et al.*, 2011; Von Felten *et al.*, 2012), because it is related to changing conditions such as the industry environment (Von Felten *et al.*, 2012). The added value of FM support services will therefore be determined by contextual factors such as industrial sector, specific situations, and the type of relationship between FM and the core business (Jensen, 2010-a).

The creation of added value according to Williams (1996) is "the process whereby products and services are provided to the required performance for the lowest cost. It requires the elimination of any redundant performance." When determining added value, there should be closely monitored which tasks are not needed and do not add value to the core business of the organisation. In addition, the tasks that do add value must be financially justified (Williams, 1996).

For this research, FM added value is defined as:

"FM added value is the customers' (subjective) observed contribution of the offered support services to the core business, based on the trade-off between costs ('give' component), benefits ('get' component), and the related risks."

Chapter two concluded that the FM discipline operates on all three organisational levels (strategic, tactical, and operational) (CEN, 2006; Chotipanich, 2004; Jensen, 2008; Jensen *et al.*, 2010; Jensen *et al.*, 2012; Patanapiradej, 2006). The previous formulated definition shows that FM added value is subjective; therefore, the assessment of added value could differ at the various organisational levels (Kok *et al.*, 2011). The needs and preferences regarding FM support services may vary per organisational level. This stems from the differences in size and the roles and tasks of the organizational levels (Kok, 2012). Ravald and Grönroos (1996) state that the differences in opinion of added value depend on personal values, needs, and preferences weighed against the financial resources of the customer. These differences in perception arise, for example, because there are differences in knowledge, tasks, and contextual conditions between the employees working on the various organisational levels. This affects the judgement of added value (Lepak *et al.*, 2007).

3.1.1 CONCLUSION

The term 'added value' is used in different contexts and with different descriptions. However, there are several aspects of added value the literature agrees on. Added value is a trade-off between benefits, costs, and risks. This trade-off is made by the customer and therefore added value is subjective. Besides this, added value is dependent on contextual factors and is dynamic. Since added value is the opinion of the customer and dependent on contextual factors, the opinions of added value might differ at various organisational levels.

3.2 DETERMINING FM ADDED VALUE

Financial indicators were traditionally used to measure services (Pitt and Tucker, 2008). Due to the shift to added value, new methods of measurement are needed. For the customer, the assessment of added value refers to the functional or emotional benefits of a product or service in relation to the financial cost and effort, as well as the risks associated with the use or non-use of the service (Kok *et al.*, 2011). To operationalize FM added value, the components of the trade-off (i.e. benefits, costs, and risks) must be defined clearly, to ensure that all customers interpret these components in the same way. This paragraph is focused on defining the components of FM added value with a sub-paragraph for benefits (3.2.1), costs (3.2.2), and risks (3.2.3).

3.2.1 BENEFITS

Since FM added value is assessed by the customer, it is important that the 'benefits' are defined from the customers' point of view. Literature refers to this with the terms 'use value' or 'customer value' (Woodruff, 1997). Customer value is about what customers want and believe that they get from buying and using a service. Woodruff (1997) defines customer value as the "customer's perceived preference for and evaluation of those product/service attributes, attribute performances, and consequences arising from use that facilitate (or block) achieving the customer's goals and purposes in use situations." Meaning that customer value is associated with the use of a product or service (Woodruff, 1997).

In this context, Bowman and Ambrosini (2000) make a distinction between 'use value' and 'exchange value'. Use value relates to the specific qualities of a product or service experienced by the customers regarding their requirements. Exchange value relates to price (Bowman and Ambrosini,

2000) and is focused on the relation between input and output (Jensen, 2009; Jensen, 2010-b). According to Bowman and Ambrosini (2000) and Lepak *et al.* (2007) it is important that potential customers assess whether the attributes of a service meet their needs. The value perception of the customer with regard to a service is made based on their needs, experiences, wants, and expectations.

In addition, Menon *et al.* (2005) do speak explicitly about benefits. They make a dichotomy in so called 'core benefits' and 'add on benefits'. Core benefits are the minimum required attributes that a supplier should provide in order to meet the needs of a customer. Add on benefits are the extras that a supplier could offer to customers.

From these three definitions, two main aspects can be derived, namely the needs of the customer and the attributes of the support services. In order to deliver added value, the support services must meet the needs of the customer. So the question is; when does a support service meet the needs of a customer? This can be traced to specific attributes of a support service, for example, speed of the provision of the service, knowledge of the service employees, etc. These specific attributes can therefore vary across services, but there can be concluded that certain specifications of a service weighs as a benefit in FM added value trade-off if it meets the needs of the customer.

3.2.2 COSTS

Besides the previously described benefits, costs are also part of the FM added value trade-off. Bowman and Ambrosini (2000) indicate costs of the trade-off as part of 'exchange value'. This is the amount a customer is paying for the services. Costs in the FM added value trade-off, seen from the supply side, are described as the value of a product or service reduced by the value of the used resources (Jensen *et al.*, 2012-a). However, these definitions do not cover the whole concept of costs in the FM added value trade-off (Coenen *et al.*, 2012-a). These definitions are about the value of a product or service in terms of money. While the FM added value trade-off is about more than just money. Customers might be looking for the lowest price when purchasing a product or service, but maybe they are looking for the best price-quality ratio of a product or service (Zeithaml, 1988). Some definitions speak explicitly about cost when it comes to FM added value. However, there are some definitions that broaden this part of the trade-off by speaking of sacrifices instead of only costs (Kumar and Grisaffe, 2004; Menon *et al.*, 2005; Von Felten *et al.*, 2012; Woodruff, 1997; Zeithaml, 1988). Sacrifices are, in addition to costs, for example the time and/or effort involved for the customer when purchasing a product or service (Zeithaml, 1988).

3.2.3 RISKS

The third part of the FM added value trade-off is the potential risks that arise from the (non) use of the offered FM support services (Jensen and Katchamart, 2012; Kok *et al.*, 2011). This concerns risks that could cause the failure of the core business, with corresponding consequences. Failure could for example be expressed in continuity of the core business (Omta *et al.*, 1997; Tucker and Pitt, 2009). In addition, in laboratories there are also specific safety and health risks, because of the use of, for example, volatile combustible substances such as alcohol and ether, carcinogens and other pathogens (Zwaard, 2010). If inexperienced FM employees (Atkin, 2003) would come in contact with these substances without knowing how to handle them, accidents might happen.

Because risks are related to the core business, it is not possible to mention all possible specific risks. They will vary per organisation and departments of an organisation. However, there is something important to mention about the way risks are being measured. When risks are being measured, it is not only the impact and consequences of these risks that matter. A risk could have a high impact and

consequences for the core business, but if this risk rarely or never occurs it is more likely this risk is accepted by the core business. Therefore the probability of the occurrence of the risk should be included in the measurements of the risks. This way a better estimate can be made about how important the risk is in the FM added value trade-off (Atkin, 2003).

3.2.4 CONCLUSION

Traditionally, financial indicators were used to measure the 'contribution' of support services. Because of the focus shift from cost reduction to added value, different measurement methods are needed. FM added value is a trade-off between benefits, costs, and risks. Benefits, from the customers' point of view, relate to the needs of the customer and can be traced to specific attributes of a support service, for example, speed of the provision of the service, knowledge of the service employees, etc. Costs relate to what the customer 'gives' when buying or using a support service, usually expressed in expenditures, also time or effort of the customers may be assessed. Risks relate to the negative impact of the (non) use of the services, causing failure of the core business and corresponding consequences. This is often expressed in terms of continuity of the core business, but can also be about for example safety and health risks. When measuring risks, not only the impact and consequences should be taken into account. The probability of the occurrence of the risk is important as well.

3.3 CONCLUSION

The concept 'added value' is used in different contexts and with different explanations. However, literature agrees that added value is an individual, subjective assessment of a customer of the benefits obtained, the sacrifices made, and risks involved with the purchase and use of a product or service. This assessment depends on the context in which purchase or use of a product or service takes place. In addition, added value is a dynamic concept; the opinion of the customer may change over time. Because added value is a subjective concept and the FM discipline is active on all three organisational levels, the opinions about FM added value may vary per organisational level. This is partly because the needs and preferences vary per organisational level.

Traditionally, financial indicators were used to measure support services. FM added value is more than costs alone, and therefore new methods of measurement are required. Because the customer determines the degree of FM added value, it is important to define the components of the FM added value trade-off (benefits, costs, and risks) from the customers' point of view. Benefits are then referring to the needs of the customer related to specific attributes of a support service. Certain researchers focus only on the costs of a product or service, while other researchers also put other sacrifices in the FM added value trade-off. The risks are mostly focused on the possible failure of the core business by the (non) use of a product or service, in terms of continuity. Besides this, risks can also be about for example safety and health risks.

The summary given above leads to the following answer to RQ3 (*How can 'FM added value' for the core business be determined?*); FM added value is a trade-off between benefits, costs, and risks. This trade-off is made by the customer of the support service. For measuring FM added value there should be determined to what extent the support services meet the needs of the customer. If so, then this is considered as a level of benefit in the trade-off. These benefits are weighed against the costs and any other sacrifices to be made by the customer. Finally, the potential risks should be determined. To be able to weigh the potential risks in the trade-off, there must be determined what the probability of the occurrences of the risks is and what the consequences might be. This all together ultimately determines the added value of FM support services.

4. ALIGNMENT BETWEEN CORE BUSINESS AND FM

Facility Management (FM) supports the core business of an organisation. For this, a so-called fit must be derived between the core business and FM when it comes to objectives and activities. This fit is achieved through alignment between the core business and FM. This certainly applies when it comes to adding value to the core business by FM. However, what alignment exactly is and how this can be achieved is not clear yet. This final chapter of the literature review will focus on alignment by answering *RQ4: What is indicative for the alignment between the core business and FM?*

The chapter starts with an explanation of the interdependencies between organisational departments (4.1). Next, the term alignment will be defined (4.2). Thereafter, the two most important elements of alignment will be discussed, namely coordination and communication (4.3). Then the conclusion to RQ4 will be given (4.4.). The chapter will conclude with the formulation of the expectations for the empirical research that were found in the literature study (4.5).

4.1 INTERDEPENDENCIES

The division between core and non-core business indicates that an organisation consists of several parts. This is also visible in Figure 1; Porter's value chain (chapter two). This division in different organisational parts creates interdependencies within an organisation (Thompson, 1967). These interdependencies can be displayed in different ways. Thompson (1967) distinguishes three types of interdependencies between organisational departments, namely:

- *Pooled:* the departments or activities are dependent on the same pool of resources;
- *Sequential:* the output from one department or activity is needed for the next department or activity;
- *Reciprocal:* the output of each department or activity is needed for all other departments or activities and vice versa.

Because of these (different) interdependencies, the need for coordination of activities arises (Kok, 2012). For this purpose, it is important to identify the different activities of an organisation. There should be determined which activities are part of the core business of an organisation. For determining the core activities of an organisation, Arnold (2000) has developed the Outsourcing model (Figure 3).
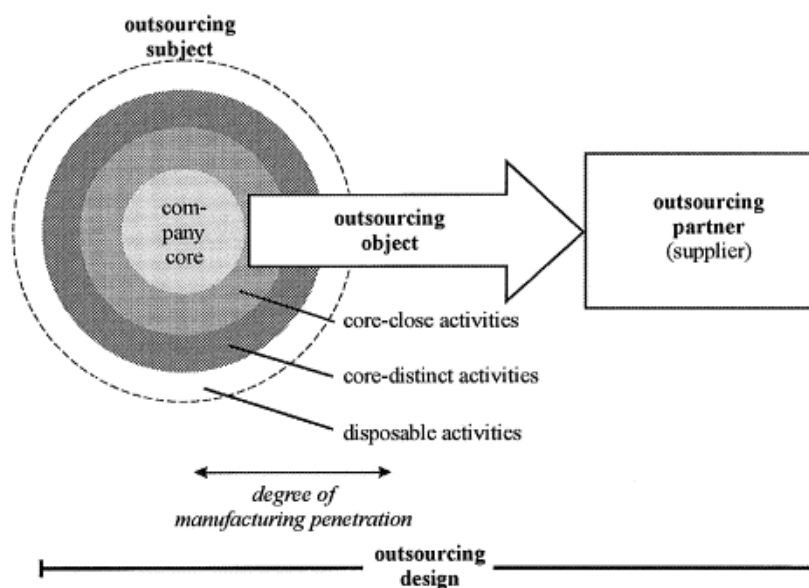
Figure 3 Outsourcing model (Arnold, 2000)

Within this model Arnold (2000) distinguishes four types of activities, namely:

1. **Company core:** all activities necessarily linked to the existence of a company;
2. **Core-close activities:** all activities that are directly related to core activities;
3. **Core-distinct activities:** the activities that are generally seen as supporting activities;
4. **Disposable activities:** all activities that are generally available to an organisation.

To support the core business of an organisation in the best possible way, FM should determine which activities are core-close, core-distinct, and disposable. These are the activities that might be provided by FM in order to support the company's core activities. Here it is important to align the activities FM will perform with the core business of the organisation and the interdependencies that arise from this. What this alignment exactly is will be defined in the next paragraph.

4.2 DEFINING ALIGNMENT

In literature scholars use different terms to refer to alignment, such as (strategic) fit, match, congruence, integration, fusion, and linkage (Avison *et al.*, 2004; Nadler and Tushman, 1980; Zajac *et al.*, 2000; Venkatraman, 1989). In the eighties Nadler and Tushman (1980) used the term alignment to explain that organisations consist of several components that communicate with each other. Between these components there is a certain balance that determines whether or not they are aligned. Venkatraman (1989) used the term fit and defines this as a "match between two related variables." Papp (1999) considers 'fit' and 'linkage' as parts of the concept alignment, both with their own definitions. He defined fit as "the alignment of external and internal environments within an organisation" and linkage is the alignment of several business domains of an organisation (Papp, 1999). Several scholars use this distinction of alignment in external fit - between an organisation and its environment - and internal fit - between components within an organisation (Smith and Reece, 1999; Venkatraman and Camillus, 1984). According to Papp (1999) alignment is important for every organisation to achieve harmony between strategies and plans, which may result in a higher profitability. Thus, a good level of fit is beneficial for the organisation (Griffith and Myers, 2004).

So alignment is about balancing the collaboration between organisational components and between the organisation and the environment. Here communication between components (Nadler and Tushman, 1980) and harmony between strategy and plans (Papp, 1999) play a role. Literature also refers to this harmony with the term 'coordination' (Hage *et al.*, 1979). But do the above given definitions also apply to the alignment between FM and the core business of an organisation? Here it is not about the alignment between equivalent organisational components, but about the alignment between core business and support (Kok, 2012). According to Kok (2012) "FM alignment concerns the coordination between FM and demand." This distinction between the FM supply side and the core business demand side is also reflected in the FM model, shown in chapter two (Figure 2) (CEN, 2006; Jensen and Katchamart, 2012). Demand represents the needs and wants of the customer which is a result from the organisation's goals and the activities that constitute the core business (Jensen, 2011; Kok, 2012; Ravald and Grönroos, 1996). Adjusting the support services provided by FM to the requests of the organisation is crucial (Chotipanich, 2044). In order to achieve this, FM should look at their support service offering from the perspective of the customer. FM should be in close collaboration with the customer in order to understand their needs and wants (Ravald and Grönroos, 1996). This requires a close collaboration and a tight connection between FM and the core business (Jensen, 2011; Jensen and Katchamart, 2012).

According to the literature, alignment has also an effect on FM added value. A good and ongoing cooperation between FM and the core business will affect the FM added value to the core business positively (Jensen and Malmstrøm, 2012). Kok *et al.* (2011) state that "the alignment of the core business and FM is also a key element to the achievement of added value and that, besides the service specifications in terms of quality and performance required, the relationship between FM and

the customer must also be considered." Also, according to Jensen (2010-b), a long-term relationship between FM and the core business is important. This suggests that the contribution of FM to the core business can be derived from the relationship between FM and the core business.

Based on the above, alignment - for this research - is formulated as follows:
"FM alignment is the coordination between the FM supply and the core business demand for support services in order to achieve a fit (which is the result of a close collaboration)."

Important in this is that an organisation is not static and changes over time. Chotipanich and Nutt (2008) state that the FM support service offering to the core business is subject to change. Therefore a so- called 'dynamic fit' is needed in order to maintain the alignment between FM and the core business of an organisation (Ciborra, 1997; Douma *et al.*, 2000; Venkatraman and Camillus, 1984; Zajac *et al.*, 2000).

4.3 COORDINATION AND COMMUNICATION

The previous formulated definition of alignment showed that alignment concerns the coordination, with related communication, between the FM supply and the core business demand. This coordination was also mentioned in the creation of a fit between the interdependent departments of an organisation. But what exactly is this coordination? Hage *et al.* (1979) defines coordination as "the degree to which there are adequate linkages among organizational parts, i.e. specific task roles as well as subunits of the organisation so that organisational objectives can be accomplished." The different tasks in an organisation and the degree of uncertainty are important indicators for the desired degree of communication (Hage *et al.*, 1979). According to the literature, coordination and accompanying communication can be realized in three different ways:

- *Coordination by standardization*: is the establishment of routines and rules. Important in this way of coordination is that the situations where the rules and routines will apply, are relatively stable and repetitive in character (Thompson, 1967).
- *Coordination by plan*: is based on the preparation of schedules for interdependent components (Hage *et al.*, 1979; March and Simon, 1958; Thompson 1967). This type of coordination is more suitable for dynamic situations, because it requires a lower level of stability and routinization than coordination by standardization (Thompson, 1967).
- *Coordination by feedback*: is about the transfer of new information (Hage *et al.*, 1979; March and Simon, 1958; Thompson 1967). This coordination form is sometimes called mutual adjustment (Thompson, 1967). The more unpredictable a situation is, the higher the dependence will be on this form of coordination (March and Simon, 1958; Thompson, 1967). According to Kok (2012) "this can be established by interpersonal communication (dialogue) and group communication involving more than two people having scheduled and unscheduled meetings."

To create a fit between FM and the core business, it is important to determine the needed support service offerings and corresponding coordination and communication for the departments within the organisation. Is it a department with a lot of routine work with a number of pre-defined regulation, then 'coordination by standardization' can be used for the alignment. However, once the work becomes less predictable, one of the other coordination forms should be chosen. If it concerns a support service offering with schedules and guidelines, 'coordination by plan' is the coordination option. If a lot of information must be exchanged between FM and the core business, such as with a customized support service, 'coordination by feedback' is the best way of coordinating the support service.

4.4 CONCLUSION

Between organisational parts various types of interdependencies exist. These interdependencies create the need for coordination. To determine the desired type of coordination, the different activities of an organisation should be established together with the role FM could have in the organisation of these activities. This is important, because FM alignment is the coordination between FM supply and core business demand. Because this is a dynamic process, it is referred to as a 'dynamic fit'.

The type of coordination and related communication depends on the type of work done by a department. A department with a routine character could be coordinated through standardization. If schedules and guidelines could be used to organise the support services for a department, then 'coordination by plan' could be used. If information should be exchanged on a regular basis to support a department, 'coordination by feedback' is the best coordination form.

From this summary the answers to RQ4 (*What is indicative for the alignment between the core business and FM?*) can be derived; indicative for alignment is the coordination, with corresponding communication, between the FM supply side and the core busies demand side. To determine the best type of coordination for the alignment between FM and the departments within the organisation, there should be determined what activities an organisations core business has and what characteristics these activities have.

4.5 THEORETICAL EXPECTATION EMPIRICAL RESEARCH

The literature study will be used to design the empirical part of this research. This literature study revealed important conclusions. First of all, literature showed that the scope of FM depends on the core business of an organisation. Here added value has an important role, because of the focus shift within the FM discipline from cost reduction to added value. FM delivers added value to the core business when the offered support services meet the needs of the customer. According to the literature this requires alignment between FM and the core business. This alignment could results in a fit if the FM supply meets the core business demand.

This input from the literature study is used to formulate a theoretical expectation for the empirical part of this research. This theoretical expectation is formulated as follows:

"If, by means of good alignment, the facility service requirements meet the needs of the customer (i.e. a fit), then the support service offering of FM is of added value of the core business."

5. METHODOLOGY

This chapter describes the methodology used for the data gathering of the empirical part of this research. The aim of the empirical study was to investigate support services, found in the literature study, that FM may deliver to laboratories in order to achieve FM added value. This is necessary to determine what facility service requirements FM should meet in the support of laboratories in order to achieve a fit. To investigate this, a case study research has been conducted within four organisations. This case study research included 23 semi-structured interviews and a questionnaire. This chapter starts with an explanation of the case study research (5.1). Thereafter the target group, design, and methods of analysis off the questionnaire will be explained (5.2). In addition the target group, design, and method of analysis of the interviews will be explained (5.3). In the last paragraph the concepts of validity and reliability will be discussed (5.4).

5.1 CASE STUDY RESEARCH

For this research a case study research was done. Verschuren and Doorewaard (2010) describe a case study research as a research strategy in which the researcher tries to gain a profound and full insight into one or several objects or processes that are confided in time and space. There are two variants of case study research strategies; the single case study and the comparative case study. The comparative case study differs from the single case study in the amount of cases: a comparative case study uses several comparable cases instead of one (Verschuren and Doorewaard, 2010). Because this research focused on determining the facility service requirements a FM department must meet in order to support laboratories in the best possible way, the comparative case study research was chosen. With this research approach a comparison can be made between different case organisations providing insight in the possible service support FM departments can deliver to laboratories.

The literature study showed that support services FM may offer to laboratories were not widely studied in science. To get a broad picture of the research topic, it was envisioned to engage several organisations in the research with various research fields and from different industries. Ultimately, three peer organisations were found to compare with Wageningen UR. The first organisation (Organisation X) is a profit organisation active in the dairy industry. Secondly, Organisation Y, is a research institute which performs basic and strategic ecological research. The third and last organisation (Organisation Z) is an independent laboratory specialised in sampling and testing in the field of food, feed, and environmental safety.

5.1.1 SAMPLE

The aim of the empirical study of this research was to investigate support services FM may deliver to laboratories in order to achieve FM added value. The various organisational levels could have different opinions about the FM added value and thus the requirements of the delivered support services. Therefore it was important to involve multiple organisational levels in the empirical part of this research. Two methods for data gathering concerning the case study research were used: questionnaires and interviews. Laboratory employees at the operational level were asked to fill out the questionnaire. For the interviews, laboratory managers and facility managers at the tactical level of the organisations were asked to participate. The strategic organisational level is focused on designing and determining the strategy for the entire organisation, not specific for laboratories. The tactical and operational organisational levels are aimed at creating the conditions for implementing and executing this strategy. This research is focused on the use of support services and the user perspective about these support services, thus on the operational level. The tactical level is the linking pin between the strategic and operational organisational levels and influences this use and

user perspective by managing the support services. Because of these reasons we assumed that the strategic organisational level could not provide extra information regarding the support service requirements for laboratories. Therefore we decided to exclude this organisational level within this research. More about the reasons for the methods of data gathering, the operationalization of the data gathering, and analysis of the data will be given in the next paragraphs; 5.2 and 5.3.

5.2 QUESTIONNAIRES

For this research, laboratory employees evaluated the FM added value of the different FM laboratory support services at the operational level using a questionnaire. According to Kumar (2005) "a questionnaire is a written list of questions, the answers to which are recorded by respondents." This questionnaire is the main source of information for this research. An advantage of a questionnaire is that a large group of respondents can be approached (Verschuren and Doorewaard, 2010). This benefit was taken into account when deciding to use questionnaires at the operational organisation level. This way, as many opinions of laboratory employees as possible could be included in this research.

Laboratory employees were the target group for the questionnaires. The reason behind this decision was that the laboratory employees use the provided FM support services in their daily operations. Therefore we expected that they can properly assess whether the services add value to their core business or not. Laboratory employees are defined as the employees who need a laboratory for (part of) their work activities; i.e. researchers, analysts, and PhD candidates. The sample size for the questionnaires depends on the number of laboratory employees at the organisational unit.

For security reasons, not all laboratories were freely accessible, which made it difficult to use a paper version of the questionnaire. Therefore it was decided to use the Internet tool Qualtrics and send the questionnaire by e-mail. To keep all questionnaires consistent, all organisations were approached in the same way.

5.2.1 QUESTIONNAIRE QUESTIONS

The input for the design of the questionnaire emerged from the literature study. Within this literature study we concluded that FM added value is a trade-off between benefits, costs, and risks. The questionnaire was designed to measure this FM added value trade-off at the operational organisational level. Since the employees on this organisational level are not confronted with the costs of the delivered support services, we excluded this component of the FM added value trade-off from the questionnaire. The employees at the operational level primarily determined the benefits of the offered support services in terms of their use value (Woodruff, 1997), by answering questions about the quality of specific service attributes related to employees' requirements. A positive evaluation of a support service's quality is seen as a benefit for their core business, and, vice versa negative evaluation is seen as a risk for their core business. As mentioned in the literature study, risks relate to the negative impact on the (non) use of the services, causing failure of the core business and corresponding consequences. So, if a support service is not organised by FM as promised, this could have far-reaching consequences for the core business and thus this is a risk.

In the output of the literature study a list of fourteen FM support services specifically for laboratories was included. This list was converted into twenty questions about the specific attributes of the services that affect the work of the employees in the laboratories. There were also two general questions about service support for laboratories. For the assessment of these characteristics a 7-point Likert scale was used from 1. 'very poor' to 7. 'very good'. Besides this, employees could enter 'not applicable' (N/A) if the service did not apply to their work situation; for example if they do not need a specific support service for their work in the laboratory. An overview of the fourteen services with corresponding questions and characteristics can be found in Appendix IV.

Besides these questions related to laboratory support services, the respondents were also asked to fill in some demographic data, such as age, gender, function, and number of hours spent in a laboratory. The demographic data was used to assess if this possibly affects the wishes of the laboratory employees for facility support for laboratories.

At the end of the questionnaire one open question was posed about support services for laboratories that, according to the employees, were missing in the questionnaire. The complete questionnaire can be found in Appendix V.

5.2.2 DATA ANALYSIS

After collecting the data using the questionnaire, the dataset was analysed using the computer program SPSS. The analysis of the dataset consisted of various parts. First of all, the Cronbach's alpha was calculated, which determines the reliability of the used 7-point Likert scale (Field, 2009). More about this reliability will be explained in paragraph 5.4.

A comparative case study research was chosen, since this gives the possibility to make a comparison between different organisations. Therefore, one of the methods of analysis had to focus on comparing the four case organisations; the Kruskal-Wallis test. This test was designed to analyse whether more than two independent groups differ (Field, 2009). The test works with a null hypothesis assuming there are no differences between the opinions of the employees in the different organisations. With this analysis, the four peer organisations will be compared to determine for which support services the results of the questionnaire differed (Field, 2009). The Kruskal-Wallis test only shows if there are differences, it does not provide details about these differences. Therefore, if the results Kruskal-Wallis test show differences between the four organisations, the Mann-Whitney test will be done to determine these exact differences (Field, 2009). Field (2009) stated that the Mann-Whitney test "looks for differences between two independent samples."

Thereafter, a principal component analysis (PCA) was done. According to Field (2009) a PCA is "a technique for identifying whether the correlations between a set of observed variables stem from their relationship to one or more latent variables in the data." In other words, the PCA determines which components can be identified from the dataset. In addition, the PCA visualizes which services are related to each other and might influence one another. This can be useful information in the composition of a support service offering for laboratories. Moreover, PCA makes the dataset more manageable during the analyses.

The components formed during the PCA were then used in the regression analysis. According to Vaske (2008) "regression is a general statistical technique for analysing the relationship between a dependent variable and one or more independent (i.e., predictor) variables." The regression analysis was used to investigate the influence of the extracted components of laboratory support services on the opinion of the overall facility services and the contribution of the facility services to the work in the laboratories.

5.3 INTERVIEWS

An interview is more suitable to gather in-depth information and supplement or clarify known information, though it must be said that interviews are time consuming (Kumar, 2005). The interviews in this research were used as extra validation of the results of the questionnaire. In addition, they were also used to clarify why certain services may or may not be offered and why certain services are organized in a specific way. Interviews were held at the tactical organisational level with facility managers and laboratory managers. For this research a facility manager was defined as the person who is responsible for all support services for the specific location of the organisation. Laboratory managers are defined as the people who arrange everything within the laboratory; i.e. that the desired goods are present and all equipment is operational.

There are several types of interviews, such as unstructured interviews, structured interviews, and several intermediate types (Kumar, 2005). For this research we decided to do semi-structured interviews. In this type of interview, the questions and order of questions are determined in advance (Kumar, 2005). This way, all interviewees get the same questions in the same wording and order (Verschuren and Doorewaard, 2010). This was done, because this made it possible to compare the responses given in the different interviews. It were semi-structured interviews, because the interviewer had the possibility to ask additional sub-questions to get all the necessary information.

For the consistency of the research the same person conducted all interviews. In addition, an interview manual was prepared (appendix VI). This way we ensured that all interviews were conducted the same way. Besides this, all interviews were recorded with the permission of the interviewees and transcripts of the interviews were made. Furthermore, the aim was to do all interviews individually, this way the answers of the interviewees were not influenced by other people. However, three interviews were held in pairs. Two of these interviews in pairs were done at the FM-side. The concerned facility manager recommended to invite a colleague or a member of the executing staff with more knowledge about the way the laboratories in their buildings are supported. One interview at the laboratory side was done in a pair, because those two people fulfilled the position of laboratory manager of that specific laboratory together.

5.3.1 INTERVIEW QUESTIONS

Similar to the questionnaire, the input for the design of the interviews emerged from the literature study. The list of fourteen support services specifically for laboratories was used to design questions about the current organisation of the support services. This included the communication between FM and the laboratories and the reasons behind this way of organising the support services (i.e. risks, knowledge and skills, finance, practical reasons, etc.).

The interviews started with a background question (i.e. *'Wat kunt u mij vertellen over uw functie hier in deze organisatie?'*) to get more clarity on the function (or role) of the interviewee within the organisation. This question was asked to determine whether the functions with corresponding responsibilities of the various interviewed people in the four organisations were comparable.

Then there were two questions asked about the current alignment between FM and the laboratories. These questions were asked to determine the types of communication and coordination that might lead to alignment between FM and the core business of an organisation and thus FM added value.

Thereafter the fourteen support services for laboratories were discussed using the same set of three questions. The first question focused on the current organisation of the services, i.e. by FM, the laboratories or an external provider. Secondly, the motivations for the choice of organisation of the support services were discussed, focussing on risks, knowledge, expertise, quality, financial and practical considerations. The third and final question focused on who should organise the support services within the organisation (i.e. FM, the laboratories or an external provider) and the reasoning behind this according to the interviewee.

As a last question we asked respondents to indicate whether any support services were missing in our research. This question was asked because the list of support services was based on information from two documents of Wageningen UR only. It might be possible that the other case organisations or other organisational parts of Wageningen UR provide other support services for the laboratories which were not included in this research.

For the analysis of the interviews a content analysis was conducted. According to Kumar (2005) a content analysis makes it possible to "identify main themes that emerge from the descriptions given by respondents in answer to questions." This method of analysis was chosen, because it analyses subjective data in an objective way. The method starts with a global search for main themes within the interview transcripts. Thereafter all interviews were thoroughly read to count the frequency these themes were discussed in the interview and to gather quotes per theme. We then used this information as additional explanation of the results of the quantitative analysis. Table 3 gives an overview of the used search terms in the content analysis. Per question theme the search terms were displayed.

Question theme	Search terms
Alignment	'document'; 'protocol'; 'structure'; 'lab-committee'; 'ad hoc'; 'meeting'; 'weekly'; 'monthly'; 'calling'; 'mail'; 'Facility Desk'
Current service provider	'FM'; 'laboratory'; combination of FM and laboratory'; 'external provider' (including names of external providers)
Motivation current organisation	'risks', 'knowledge', 'expertise', 'quality', 'financial', 'practical'; 'historical'; 'responsibility'; 'experience'
Ideal service provider	'FM'; 'laboratory'; 'combination of FM and laboratory'

Table 3: Search terms content analysis

5.4 VALIDITY AND RELIABILITY

To translate the SPSS-output of the dataset and the content analysis of the interviews into useful answers to the (general) research question(s), reliable and valid information is needed. The reliability of a measurement method refers to the repeatability and accuracy of this method. A method is reliable as repetitions of measurements yield the same results under the same research conditions (Kumar, 2005). As mentioned in paragraph 5.2.2, the reliability of the questionnaire scale is tested with the Cronbach's alpha calculation. To increase the reliability of the interviews an interview manual was prepared and used for every interview of this research (appendix VI).

According to Kumar (2005) validity "ensures that in a research study correct procedures have been applied to find answers to a question." Or in other words, the validity of a measurement method refers to the degree to which the method measured what it has set out to measure (Kumar, 2005).

6. RESULTS

This chapter provides an overview of the results of the empirical study. First the results of the questionnaire at the operational level will be discussed. The data obtained through the questionnaire has been analysed using the statistical analysis program SPSS. Thereafter, an overview will be given of the results of the interviews at the tactical level. For the analysis of the interviews, the qualitative method of content analysis has been used.

The chapter starts with an overview of the descriptive data from the questionnaire, including the response and non-response and Cronbach's alpha (6.1). Thereafter the SPSS analyses will be discussed, starting with the results of the Mann-Whitney test (6.2). Then the results of the Principal Component Analysis (PCA) are given (6.3). The last SPSS analysis is the regression analysis, whereby the dataset in total was analysed as well as the individual organisations (6.4). Subsequently the focus will be on the interview analysis with a detailed description of results for the fourteen support services (6.5). The chapter ends with the results of the interview and questionnaire question focused on possible missing support service within this research (6.6).

6.1 COLLECTED QUESTIONNAIRE DATA

The questionnaire was used to evaluate the FM added value of the different laboratory support services at the operational level of the four peer organisations. The sub-paragraphs below provide information about the response and non-response of the questionnaire (6.1.1), give an overview of the descriptive statistics of the respondents of the questionnaire (6.1.2), provide information about the option 'not applicable' (N/A) in the questionnaire (6.1.3), and discus the reliability of the questionnaire (6.1.4).

6.1.1 RESPONSE AND NON-RESPONSE

In total, 1,195 questionnaires were send to (laboratory) employees in four organisations; 530 to Wageningen UR, 380 to Organisation X, 260 to Organisation Y, and 25 to Organisation Z. Altogether, 317 employees started the questionnaire. The dataset used during the analysis contained 238 usable questionnaires. This number of usable questionnaires were all complete questionnaires, which gives a response rate of 19.9 per cent.

Three categories of outliers were found in the responses. First of all there was a group of 112 respondents who did not fill in any of the questions about laboratory support services. Second, there were 8 respondents who filled in only the first half of the questions about laboratory support services. These questions were divided into two screens of the questionnaire program. The third and last group of outliers was a group of 3 respondents who filled out the questionnaire, even though they do not use a laboratory during their work.

There are a number of reasons for the non-response of the questionnaire. First of all, the non-response is partly caused by vacations and leave of laboratory employees. Multiple out of office e-mails were returned. Because we did not send the questionnaire ourselves, due to privacy reasons, the exact number of vacations and leave is unknown. Another important reason for the non-response is that the questionnaire was also sent to employees who do not work in a laboratory. Within Organisation X and Organisation Y there was no overview of employees who use a laboratory for their work. Therefore we decided to send the questionnaire to all employees, with the remark that the questionnaire was aimed at laboratory employees. Three employees filled out the questionnaire even though they do not work in a laboratory ("I never work in a laboratory, but got a reminder that I had to fill in the questionnaire"). Table 4 (on the next page) gives an overview of the respondents and outliers per peer organisation.

	WUR	X	Y	Z	Dataset
Respondents	194	111	52	14	371
Outliers					
No entries	46	49	23	4	122
Half-completed	4	3	1	0	8
Does not work in lab	0	3	0	0	3
Total	**144**	**56**	**28**	**10**	**238**

Table 4: Overview respondents and outliers

6.1.2 DESCRIPTIVE STATISTICS

This sub-paragraph describes the background information of the respondents of the questionnaire. This information will be used to better interpret the results of the coming analyses.

Of the 238 respondents, 126 were male (52.9 per cent) and 112 were female (47.1 per cent). Figure 4 gives an overview of the percentages male-female per peer organisation. The only notable male-female ratio is seen at Organisation Z, where 70 per cent of the respondents were male. In the other organisations, the percentages of male and female respondents were about the same and comparable to the total dataset.
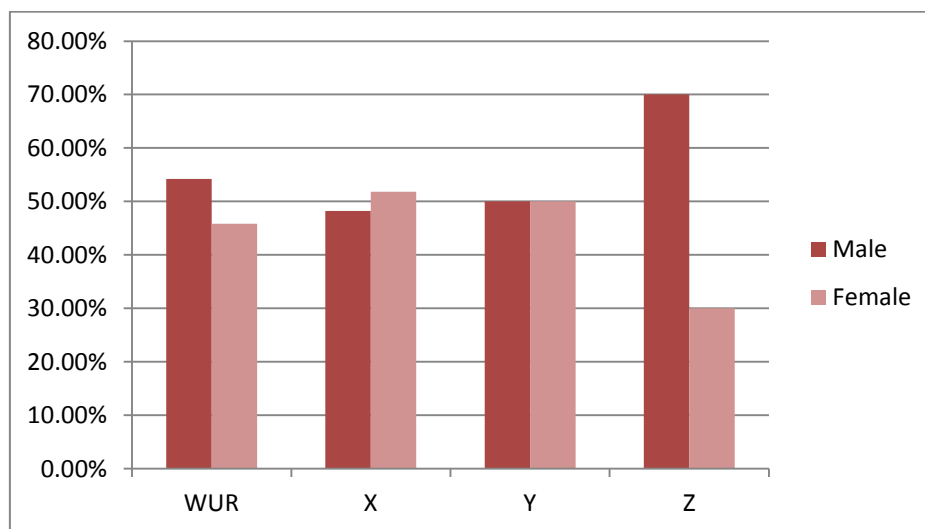
Figure 4: Gender distribution per organisation

The average age of the respondents was 41.8 years. Furthermore, there were two peaks discovered in the age of the respondents, namely around the age of 30 and 50 years. The average age of the respondents of Wageningen UR and Organisation X was also around 40 years; Wageningen UR 43.9 years and Organisation X 41.4 years. However, the average age of the respondents of Organisation Y and Organisation Z was lower with 34.9 years for Organisation Y and 33.8 years for Organisation Z.

The third descriptive question in the questionnaire was about the hours spent in a laboratory by the respondents. Figure 5 (on the next page) gives an overview of the hours spent in a laboratory per organisation. The numbers of respondents were converted into percentages of respondents of an organisation. Figure 5 shows that the respondents of Organisation X spend the least time in a laboratory. In contrast with this are the respondents of Organisation Z; more than 50 per cent of the respondents of this organisation spends more than 35 hours per week in a laboratory. After

Organisation Z the employees of Wageningen UR spend most time in a laboratory during their workweek with a higher percentage than the other organisations for the answer '25 to 35 hours'.
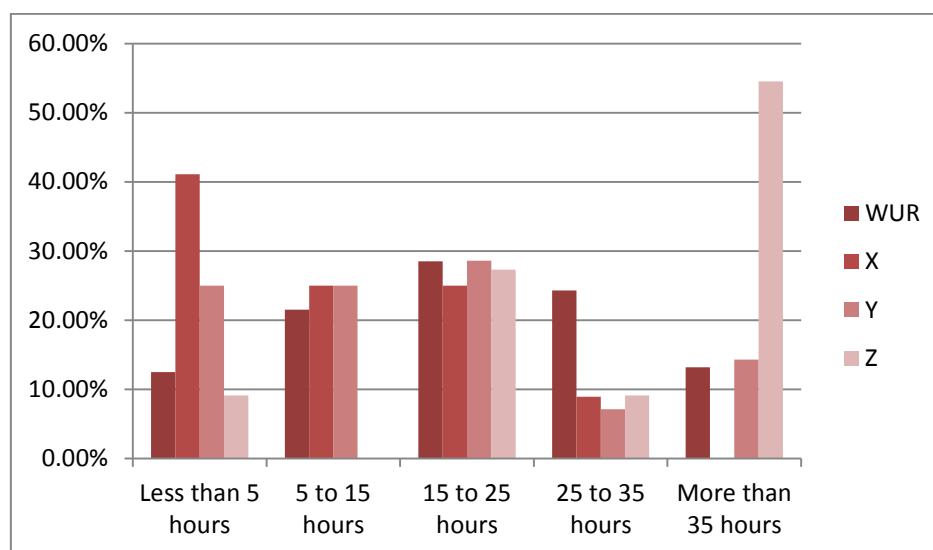
Figure 5: Hours spent in a laboratory

The last descriptive question in the questionnaire was about the description that best suited the respondents. In Figure 6 the results of this question are shown. Just like the question about the hours spent in a laboratory, the numbers are converted into percentages of respondents of the organisations. The first three answer options were almost not used by the respondents. The major part of the respondents consists of researchers, analysts, and other functions. Wageningen UR has a high number of analysts, nearly 60 per cent. In addition, Organisation X and Organisation Z have a high number of other functions. More than half of the respondents of Organisation X that used the option 'other' were product or packaging developers. Within Organisation Z, these respondents either have a dual role or a supporting function such as the front office.
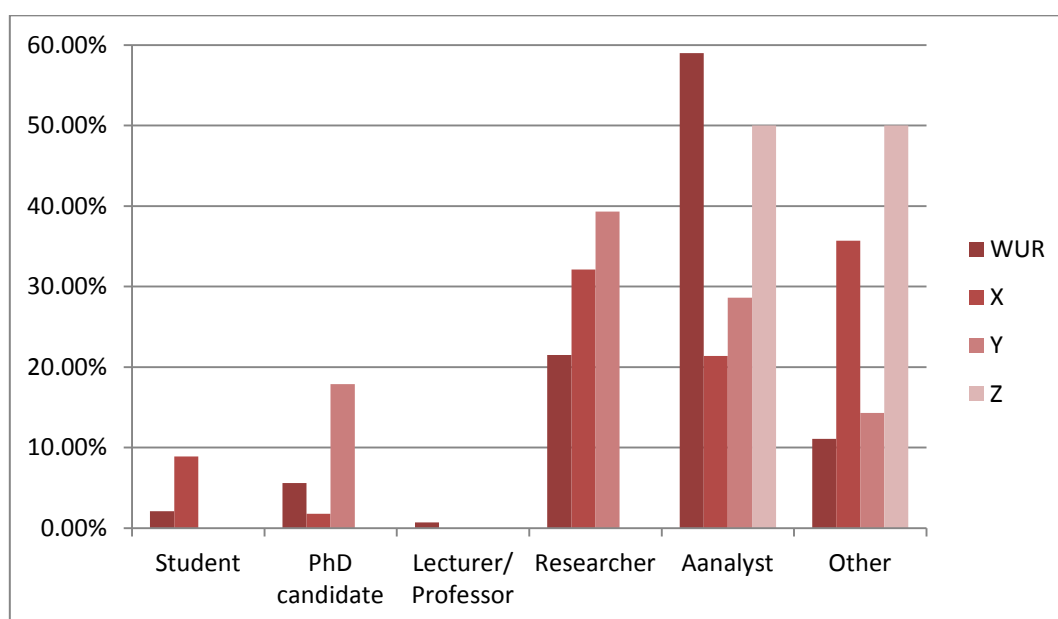
Figure 6: Descriptions best suiting respondents

Table 5 (on the next page) provides a summary of the responses to the four demographic questions per peer organisation and for the total dataset.

		Total dataset	WUR	X	Y	Z
Gender	**Male**	52,9%	54,2%	48,2%	50,0%	70,0%
	Female	47,1%	45,8%	51,8%	50,0%	30,0%
Age	**Year**	41,8	43,9	43,4	33,8	41,8
Hours spent in lab	**Less than 5 hrs.**	20,6%	12,5%	41,1%	25,0%	9,1%
	5 to 15 hrs.	21,8%	21,5%	25,0%	25,0%	0,0%
	15 to 25 hrs.	27,3%	28,5%	25,0%	28,6%	27,3%
	25 to 35 hrs.	18,1%	24,3%	8,9%	7,1%	9,1%
	More than 35 hrs.	12,2%	13,2%	0,0%	14,3%	54,5%
Description respondents	**Student**	3,4%	2,1%	8,9%	0,0%	0,0%
	PhD candidate	5,9%	5,6%	1,8%	17,9%	0,0%
	Lecturer/professor	0,4%	0,7%	0,0%	0,0%	0,0%
	Researcher	25,2%	21,5%	32,1%	39,3%	0,0%
	Analyst	46,2%	59,0%	21,4%	28,6%	50,0%
	Other	18,9%	11,1%	35,7%	14,3%	50,0%

Table 5: Descriptive statistics per organisation

6.1.3 OPTION 'NOT APPLICABLE'

The option 'not applicable' (N/A) does not provide information about how respondents evaluate the support services. Therefore, the respondents who filled in N/A for a particular question were not included in the analysis of this question. Table 6 gives an overview of the questions of the questionnaire with corresponding number of respondents, the mean per organisations, and the mean of the total dataset.

Question	n	WUR	X	Y	Z	Total
How do you evaluate the traceability of the samples required for your work?	154	5,74	4,70	6,11	4,40	5,52
How do you evaluate the availability of information concerning your samples in the registration system, such as time of entry and the actions that have been performed with the sample?	124	5,45	4,29	6,00	4,80	5,23
How do you evaluate the accuracy of all the needed information of the samples in the registration system?	121	5,49	4,63	6,00	4,90	5,34
How do you evaluate the storage of samples according to the required conditions?	174	5,78	5,39	6,08	5,00	5,71
How do you evaluate the preparation of the samples in the correct way, if carried out by someone else?	141	6,01	5,76	6,06	5,40	5,93
How do you evaluate the permanency of the temperature conditions of equipment such as refrigerators and freezers) in your laboratory?	214	5,81	5,76	5,93	5,50	5,80
How do you evaluate the authorized access to your laboratory?	202	5,61	5,31	5,78	4,10	5,49
How do you evaluate the indoor climate in the laboratory in relation to your work activities?	224	4,93	5,44	5,92	3,80	5,10

How do you evaluate the maintenance conditions of the laboratory you work in (i.e. ceiling, floors, walls, interior)?	226	5,5	6,19	6,40	5,40	5,74
How do you evaluate the functionality of the equipment in your laboratory?	214	5,53	5,81	6,35	5,11	5,66
How do you evaluate the cleanliness of your laboratory?	228	5,01	5,50	5,88	5,20	5,22
How do you evaluate the availability of clean glassware in your laboratory?	199	5,56	5,89	6,08	5,33	5,68
How do you evaluate the cleanliness of the glassware in your laboratory?	175	5,56	6,11	6,15	5,22	5,75
How do you evaluate the timely availability of various laboratory supplies in your laboratory?	203	5,50	5,12	5,88	5,10	5,45
How do you evaluate the timely availability of various chemicals for your laboratory?	191	5,74	4,94	6,15	5,44	5,65
How do you evaluate the accuracy of the registration of the various chemicals?	185	5,53	3,97	6,08	5,44	5,36
How do you evaluate the timely availability of various gasses for your laboratory?	139	5,87	5,70	5,88	5,88	5,84
How do you evaluate the adequacy of the removal of chemical waste out of the laboratories?	184	5,52	4,75	6,16	5,67	5,50
How do you evaluate the swift intervention in the event of disruptions in your laboratory?	188	5,39	4,97	5,95	5,40	5,38
How do you evaluate the safety of the laboratory work environment?	224	5,59	5,62	6,08	5,00	5,62

Table 6: Used respondents per question

Four questions had the lowest number of respondents due to the N/A option of the questionnaire:
- *How do you evaluate the accuracy of all the needed information of the samples in the registration system? (n = 121)*
- *How do you evaluate the availability of information concerning your samples in the registration system, such as time of entry and the actions that have been performed with the sample? (n = 124)*
- *How do you evaluate the preparation of the samples in the correct way, if carried out by someone else? (n = 141)*
- *How do you evaluate the timely availability of various gasses for your laboratory? (n = 139)*

The following four questions had the highest number of respondents of all questions:
- *How do you evaluate the indoor climate in the laboratory in relation to your work activities? (n = 224)*
- *How do you evaluate the maintenance conditions of the laboratory you work in (i.e. ceiling, floors, walls, interior)? (n = 226)*
- *How do you evaluate the cleanliness of your laboratory? (n = 228)*
- *How do you evaluate the safety of the laboratory work environment? (n = 224)*

Besides the number of respondents per question, Table 6 also shows the average answers (mean) per question of the total dataset and per peer organisation. For each question, the average answer of the total dataset is between 5 ('moderate') and 6 ('good'). In other words, on average each support service scored sufficient. The lowest mean was for 'indoor climate' with an average of 5.10. 'Sample preparation' received the best score with an average of 5.93.

The average scores of the four organisations deviate from the average scores of the total dataset. Table 4 showed that Wageningen UR had more respondents than the other organisations. In other words; Wageningen UR is dominant in the dataset and therefore has a relatively high impact on the average scores of the total dataset. We decided not to compensate for this in the results, because the answers of respondents from the other organisations will get more impact on the results and this might give a distorted image. The differences between the organisations will be tested with the Mann-Whitney test.

Organisation Y scored the highest average score of the four organisations. This was for the question about the removal of the chemical waste, namely a 6.16 (6 = good and 7 = very good). The lowest average score was for Organisation Z for the question about the indoor climate, this average was 3.8 (3 = fair and 4 = almost moderate).

6.1.4 RELIABILITY QUESTIONNAIRE

Before the analyses of the dataset were done, we investigated if the questionnaire scale was reliable. According to Field (2009) "reliability means that a measure [or in this case questionnaire scale] should consistently reflect the construct that it is measuring." In other words, the results of the individual items of the questionnaire must be consistent with the overall questionnaire (Field, 2009). To analyse the scale reliability of the questionnaire we calculated Cronbach's coefficient alpha, α. For a questionnaire scale to be reliable, a Cronbach's α higher than .7 is needed. The questionnaire used in this research had a high reliability, because Cronbach's α = .95.

6.2 MANN-WHITNEY TEST

To compare the case organisations, first the Kruskal-Wallis test was done to determine whether there were differences in answers given by the respondents of the four organisations. The output of this test showed differences in the answers of 16 of the 20 questions. However, the output does not specify what the differences are and between which of the four organisations these differences can be found. Therefore we decided to do the Mann-Whitney test. The Mann-Whitney test examines whether there are differences between two independent samples. In this research the test was used to investigate the differences in response between the four participating organisations. Table 7 (on the next page) gives a summary of the results of the Mann-Whitney test.

In order to compare all four peer organisations with each other, the Mann-Whitney test was performed six times. Per analysis a column was created in Table 7 with the differences in the average response of the organisations to the questions. For example Wageningen UR and Organisation X the first question: Wageningen UR scored an average of 5.74 and Organisation X 4.70. The table shows this as a difference of +1.04 with a significance level of P < 0,001, because Wageningen UR scored higher than Organisation X.

One of the biggest differences in answers is traced back to Organisation X and Organisation Y for question 16 (How do you evaluate the accuracy of the registration of the various chemicals?) where Organisation Y scored 2.11 higher than Organisation X. Besides this, the other big difference is traced back to Organisation Y and Organisation Z for question 8 (How do you evaluate the indoor climate in the laboratory in relation to your work activities?). For this question, Organisation Y scored 2.12 higher than Organisation Z. Furthermore, question 6 (How do you evaluate the permanency of the temperature conditions of equipment such as refrigerators and freezers in your laboratory?) and question 17 (How do you evaluate the timely availability of various gasses for your laboratory?) do not show significant differences between the four organisations. The results of the Mann-Whitney test also showed that Organisation Y is the most positive of the four organisations. Organisation Z, on the other hand, is the most negative compared to the other organisations.

Question	WUR/X	WUR/Y	WUR/Z	X/Y	X/Z	Y/Z
1. How do you evaluate the traceability of the samples required for your work?	1.04 *		1.34 *	-1.41 **		1.71 *
2. How do you evaluate the availability of information concerning your samples in the registration system, such as time of entry and the actions that have been performed with the sample?	1.16 **			-1.71 **		1.20 ***
3. How do you evaluate the accuracy of all the needed information of the samples in the registration system?				-1.37 ***		
4. How do you evaluate the storage of samples according to the required conditions?			0.78 **			1.08 **
5. How do you evaluate the preparation of the samples in the correct way, if carried out by someone else?			0.61 ***			
6. How do you evaluate the permanency of the temperature conditions of equipment such as refrigerators and freezers in your laboratory?						
7. How do you evaluate the authorized access to your laboratory?			1.51 **		1.21 **	1.68 **
8. How do you evaluate the indoor climate in the laboratory in relation to your work activities?	-0.51 ***	-0.99 *	1.13 ***		1.64 **	2.12 **
9. How do you evaluate the maintenance conditions of the laboratory you work in (i.e. ceiling, floors, walls, interior)?	-0.69 *	-0.90 *			0.79 **	1.00 **
10. How do you evaluate the functionality of the equipment in your laboratory?		-0.82 *		-0.54 ***		1.24 **
11. How do you evaluate the cleanliness of your laboratory?	-0.49 ***	-0.87 *				0.68 ***
12. How do you evaluate the availability of clean glassware in your laboratory?		-0.52 ***				
13. How do you evaluate the cleanliness of the glassware in your laboratory?	-0.55 ***	-0.59 ***			0.89 ***	0.93 ***
14. How do you evaluate the timely availability of various laboratory supplies in your laboratory?		-0.38 ***		-0.76 **		0.78 ***
15. How do you evaluate the timely availability of various chemicals for your laboratory?	0.8 **	-0.41 ***		-1.21 *		0.71 ***
16. How do you evaluate the accuracy of the registration of the various chemicals?	1.56 *	-0.55 ***		-2.11 *		
17. How do you evaluate the timely availability of various gasses for your laboratory?						
18. How do you evaluate the adequacy of the removal of chemical waste out of the laboratories?	0.77 ***	-0.64 **		-1.41 *		
19. How do you evaluate the swift intervention in the event of disruptions in your laboratory?		-0.56 ***		-0.98 **		
20. How do you evaluate the safety of the laboratory work environment?		-0.49 ***				1.08 ***
Percentage of differences between quality perceptions	45%	60%	25%	45%	20%	60%

Table 7: Overview results Mann-Whitney test

Significance = *P < 0,001; **P < 0,01; ***P < 0,05

6.3 PRINCIPAL COMPONENT ANALYSIS

The Principal Component Analysis (PCA) was done to examine which support services are interrelated to each other and can be identified as one component within the dataset. In order to ensure that the variables loaded maximally to only one factor, a Varimax rotation was used. In addition, the cut-off was placed at 0.5, making the variables in the components have a sufficiently high correlation. Furthermore, the missing values were excluded pair wise. This means a respondent is excluded from the analysis only for the question(s) that was not answered.

From the twenty variables, four components were subtracted during the PCA, as shown in Table 8 (on the next page). According to Field (2009) the Kaiser-Meyer-Olkin (KMO) value should be above 0.5 and values between 0.8 and 0.9 are great. The KMO in this research is 0.867 and is thereby well above the limit of 0.5 set by Field (2009). Bartlett's Test of Sphericity X^2 = 949,838, p < 0,000, indicating that the correlations between the variables were of adequate size for a PCA. The PCA provides a four component factor solution, when taking into account the Kaiser's criterion with eigenvalues larger than one. These four components together explained 66,8 per cent of the variance of the perceived quality of laboratory support services.

When determining appropriate names for the components, the variable loadings were taken into account. In addition, we have looked at comparable features of the variables within a component. The four components used in the rest of the empirical research are:

1. **Sampling handling and conditions;** all questions related to this component are about samples; receiving, registration, storage, traceability, and availability and accuracy of information about the samples. Therefore we decided to label this component as 'sample handling and conditions'.
2. **Handling laboratory supplies and laboratory safety;** three questions within this component are focused on the availability, registration and removal after use of chemicals. Besides this there is a question about the availability of laboratory supplies and two questions are focused on the safety within the laboratories. We decided to combine the questions about chemicals and laboratory supplies and call this handling laboratory supplies. Because safety is important within laboratories, this was also included in the component name: 'handling laboratory supplies and laboratory safety'.
3. **Availability of glassware & gasses and cleanliness of laboratories & glassware;** questions within this component are focused on the availability and the cleanliness of the glassware used within laboratories. There is also a question about the cleanliness of the laboratory and last but not least there is question focused on the availability of gasses. It was difficult to find one term for all these questions. Therefore the name of this component is 'availability of glassware & gasses and cleanliness of laboratories & glassware'.
4. **Systems maintenance;** all four questions within this component are directed at systems used in buildings or specifically in laboratories. Support services related to these systems are focussed on maintenance of the systems. Therefore we named this component 'systems maintenance'.

Table 8 (on the next page) shows the components found, with the corresponding variables, the component loading per variable, and the variance per component. We also measured the Cronbach's α of these components. The components used in the rest of this research had a relatively high reliability, because all Cronbach's α were above 0.75.

Component	Component loading	Cumulative % of variance
Component 1 – Sample handling and conditions *(eigenvalue 8,465; explained variance 21,027%; Cronbach's α 0,906)*		21,0
How do you evaluate the availability of information concerning your samples in the registration system, such as time of entry and the actions that have been performed with the sample?	,885	
How do you evaluate the accuracy of all the needed information of the samples in the registration system?	,869	
How do you evaluate the traceability of the samples required for your work?	,816	
How do you evaluate the storage of samples according to the required conditions?	,772	
How do you evaluate the preparation of the samples in the correct way, if carried out by someone else?	,620	
How do you evaluate the permanency of the temperature conditions of equipment such as refrigerators and freezers) in your laboratory?	,566	
Component 2 – Handling laboratory supplies and laboratory safety *(eigenvalue 2,486; explained variance 17,535%; Cronbach's α 0,888)*		38,6
How do you evaluate the timely availability of various chemicals for your laboratory?	,824	
How do you evaluate the adequacy of the removal of chemical waste out of the laboratories?	,731	
How do you evaluate the accuracy of the registration of the various chemicals?	,669	
How do you evaluate the timely availability of various laboratory supplies in your laboratory?	,659	
How do you evaluate the swift intervention in the event of disruptions in your laboratory?	,594	
How do you evaluate the safety of the laboratory work environment?	,535	
Component 3 – Availability of glassware & gasses and cleanliness of laboratories & glassware *(eigenvalue 1,368; explained variance 15,328%; Cronbach's α 0,796)*		53,9
How do you evaluate the availability of clean glassware in your laboratory?	,759	
How do you evaluate the cleanliness of the glassware in your laboratory?	,757	
How do you evaluate the cleanliness of your laboratory?	,622	
How do you evaluate the timely availability of various gasses for your laboratory?	,505	
Component 4 – Systems maintenance *(eigenvalue 1,045; explained variance 12,929%; Cronbach's α 0,753)*		66,8
How do you evaluate the indoor climate in the laboratory in relation to your work activities?	,751	
How do you evaluate the maintenance conditions of the laboratory you work in (i.e. ceiling, floors, walls, interior)?	,657	
How do you evaluate the functionality of the equipment in your laboratory?	,595	
How do you evaluate the authorized access to your laboratory?	,593	

Table 8: Components within the dataset

6.4 REGRESSION ANALYSIS

The regression analysis measured to what extent the components contribute to the quality of the facility services overall and the contribution of facility services to the work in laboratories. First the regression analysis was done for the whole dataset (6.4.1). Thereafter, the regression analysis was conducted for Wageningen UR (6.4.2) and the other peer organisations separately (6.4.3).

6.4.1 OVERALL DATASET

The results of the regression analysis for the complete dataset are shown in Table 9 (facility services overall) and Table 10 (contribution of facility services to the work in laboratories). For the results of the regression analysis for facility services overall, only factor 3 was not significant (availability of glassware & gasses and cleanliness of laboratories & glassware). This means that the other three factors influence the opinion of the overall facility services. This model had an F statistic of 9,345 and is significant at a $p < 0,001$ level. The Adjusted R^2 value is 0,346. This means that the three factors explain 34.6 per cent of the variation of the quality of facility services overall.

Factor	B	Std. Error	Sig.	F value	R^2	Adjusted R^2
Constant	5,490	0,109	0,000	9,346	0,388	0,346
1. Sampling handling & conditions	0,202	0,091	0,030			
2. Handling laboratory supplies and laboratory safety	0,451	0,146	0,003			
3. Availability of glassware & gasses and cleanliness of laboratories & glassware	0,165	0,109	0,134			
4. Systems maintenance	0,315	0,106	0,004			

Table 9: Results regression analysis total dataset for 'quality of facility services overall'

For the contribution of facility services to the work in laboratories, all factors are significant and have therefore an influence on the overall contribution of the delivered facility support services. For this model the Adjusted R^2 value is 0,667. So these four factors account for 66.7 per cent of the variation of the contribution of facility services to the work in laboratories.

Factor	B	Std. Error	Sig.	F value	R^2	Adjusted R^2
Constant	5,408	0,084	0,000	32,609	0,689	0,667
1. Sampling handling & conditions	0,266	0,070	0,000			
2. Handling laboratory supplies and laboratory safety	0,653	0,112	0,000			
3. Availability of glassware & gasses and cleanliness of laboratories & glassware	0,363	0,083	0,000			
4. Systems maintenance	0,308	0,081	0,000			

Table 10: Results regression analysis total dataset for 'contribution of facility services to the work in laboratories'

6.4.2 WAGENINGEN UR

The same regression analysis was done for the four peer organisations, starting with Wageningen UR. Table 11 and Table 12 (on the next page) show the results of both regression analyses. The first model, the overall facility services, has three significant factors. Only factor one has no significant

influence on the quality of facility services overall. The Adjusted R^2 value is 0,752, which means that the three significant factors account for 75.2 per cent of the variation in this model about the overall facility services.

Factor	B	Std. Error	Sig.	F value	R^2	Adjusted R^2
Constant	5,504	0,087	0,000	34,287	0,774	0,752
1. Sampling handling & conditions	0,116	0,082	0,166			
2. Handling laboratory supplies and laboratory safety	0,618	0,117	0,000			
3. Availability of glassware & gasses and cleanliness of laboratories & glassware	0,275	0,083	0,002			
4. Systems maintenance	0,379	0,087	0,000			

Table 11: Results regression analysis Wageningen UR for 'quality of facility services overall'

For the contribution of facility services to the work in laboratories also factor one has no significant influence. The Adjusted R^2 value is 0,701, so the three factors account for 70.1 per cent of the variation in this model about the contribution of facility services to the work in laboratories.

Factor	B	Std. Error	Sig.	F value	R^2	Adjusted R^2
Constant	5,425	0,100	0,000	26,815	0,728	0,701
1. Sampling handling & conditions	0,137	0,094	0,155			
2. Handling laboratory supplies and laboratory safety	0,637	0,135	0,000			
3. Availability of glassware & gasses and cleanliness of laboratories & glassware	0,373	0,095	0,000			
4. Systems maintenance	0,203	0,100	0,049			

Table 12: Results regression analysis Wageningen UR for 'contribution of facility services to the work in laboratories'

6.4.3 PEER ORGANISATIONS

Subsequently, the regression analysis was also conducted for the three other organisations. All these analyses were not significant or had no outcome at all. Therefore these analyses were unusable for this research. The reason that there were no results for Organisation X, Organisation Y, and Organisation Z, is that the sample size was too small for a regression analysis. This was caused by a lower number of respondents of these organisations and also because of the option N/A within the questions, as mentioned before.

6.5 INTERVIEW ANALYSE

The interviews focused on the current alignment between FM and the laboratories, the current way of organizing the support services, and the way the support services should be organized according to the interviewees. The analysis of the interviews was done with a content analysis in order to analyse subjective data in an objective way. The next two sub-paragraphs show the results of this content analysis. First the alignment between FM and the laboratories will be discussed (6.5.1.). Thereafter the results of the analysis of the fourteen support services will be discussed (6.5.2.).

To determine the current alignment between FM and the laboratories, two interview questions were focused on communication and coordination. After analyzing these two questions, various response categories were found:

- ***Directly:*** the communication between FM and the laboratories is ad hoc and direct (via e-mail, telephone or in person).
- ***Meeting:*** communication takes place at pre-scheduled meetings.
- ***Facility Desk (F.D.):*** laboratory employees communicate with FM via a facilities reporting system.
- ***Service Level Agreement (SLA):*** everything about the support service offering of FM is defined in a SLA.
- ***Project:*** in order to solve (structural) problems within the laboratories, project groups were formed.
- ***Laboratory-committee:*** all matters concerning the laboratories and support services are discussed in (pre-scheduled) meetings with the representatives of the laboratories.
- ***N/A:*** this option was used if the interviewee did not have an answer to the question.

The first question focused on the alignment in general. The results in Table 13 show the answers of the interviewees per organisation and in total. The alignment between FM and the laboratories is mostly direct or via a facility desk. Within Organisation Y there is a facility desk the laboratories can use. However, a number of laboratories choose to communicate directly with the facility manager. Within Wageningen UR, several types of communication were found between FM and the laboratories. This is because Wageningen UR is the only organisation with multiple locations involved in the research, each using their own communication type. The last three response categories, i.e. project, laboratory-committee, and N/A, were not found in the answers to this question. These categories were included in the table of the analysis to show the differences in answers with the other interview question about alignment.

	Directly	Meeting	F.D.	SLA	Project	Lab-com.	N/A
Organisation X	-	-	3	-	-	-	-
Organisation Y	3	-	2	-	-	-	-
Organisation Z	2	-	-	-	-	-	-
Wageningen UR	8	1	2	2	-	-	-
Total	**13**	**1**	**7**	**2**	**0**	**0**	**0**

Table 13: General alignment

The second interview question focused on the alignment when structural problems occurred in the laboratories. The outcome of the analysis of this question is shown in Table 14 (on the next page). Four interviewees have not encountered this situation and are therefore marked as N/A. If structural problems occur in laboratories, the communication style is more diverse than during general alignment. The group of respondents using a facility desk for their communication remains almost the same. However, the group that communicates directly with the facility manager is considerably smaller. For discussing and resolving structural problems within the laboratories, (temporary) projects and laboratory-committees are used.

	Directly	Meeting	F.D.	SLA	Project	Lab-com.	N/A
Organisation X	1	-	1	-	-	1	-
Organisation Y	-	1	3	-	1	-	-
Organisation Z	1	-	-	-	-	-	1
Wageningen UR	3	1	2	-	1	4	3
Total	**4**	**2**	**6**	**0**	**2**	**5**	**4**

Table 14: Structural communication

As an additional question about alignment there was asked whether there are any documents or protocols established between FM and the laboratories. Most interviewees answered negative to this questions. Sometimes they mentioned ordering procedures or protocols for handling gasses. When interviewees mention protocols, they are often talking about safety protocols. These protocols are then designed by a so called safety committee.

6.5.1 ORGANISATION OF SUPPORT SERIVCES

The largest part of the interviews was designed to discuss the fourteen support services a FM department could offer to a laboratory. For each service there was asked who provides this at the moment (i.e. FM, laboratories or an external provider). In addition, there was asked who should, according to the interviewee, provide this support service. For both questions there was also asked to explain the motivations behind the regulation. In appendix VII there are two tables shown for each support service. The first table shows who is currently providing the support service. The second table shows who should provide the support service. In order to use them in the comparison of the organisations, the answers were displayed per organisation. There were a number of answers given by the respondents; i.e. FM, laboratories, a combination between FM and the laboratories, outsourced, N/A or don't know (D/N). This sub-paragraph describes the main differences found in the tables in appendix VII per support service.

Sample reception & administration
This support service is usually organised by FM and the laboratories together. FM receives all goods for the building, including samples. The laboratories are responsible for the administration of the samples. As an answer to the question 'who should organise this support service', the majority of interviewees stated the laboratories. The main reason is that the responsibility for the samples should stay within the laboratories and if a sample is received by FM, they should immediately call someone from the laboratory. The most cited reasons where: knowledge of the samples, skills to handle the samples, and keep the risks for the research to a minimum.

Sample storage
At the moment, the laboratories are responsible for the sample storage. All 23 interviewees indicated this. Important to mention is that most of the time FM provides the storage space and the laboratories are responsible for the storage of the samples. When looking at the second table, at the preferred organiser of this support service, interviewees indicate a larger role for FM. This often comes down to the fact that there is not enough storage space and FM should have a back-up storage space. FM has no further saying in the sample storage, because the interview analysis shows that laboratories always want to have control over the sample storage.

Sample preparation

The tables clearly shows sample preparation is organised by the laboratories and this should stay this way. Only at Organisation X there is a combination between FM and laboratories. FM does the standard sample preparation and the laboratories do the specific sample preparation. The main reason given in the interviews is that sample preparation is part of the research process and thereby truly belongs to the primary process.

Track & trace

Tracking and tracing the samples within the organisation is either not applicable or is done by the laboratories. The main reason given by the interviewees is that track and trace is part of the research and thus part of the primary process. However there is one interviewee who thinks FM should be responsible for this support service in the future. This facility manager argues that there is a large generic part within this support service and therefore FM should be responsible.

Temperature registration

There is a variety of answers when it comes to the temperature registration service. FM is most commonly referred to as current organiser. In addition, the majority of respondents also think FM should organise this support service. However, from the answers of the respondents a discussion point occurs about who should be the first responder to an alarm of the registration system; i.e. FM because of technical failure or the laboratory employees because of their knowledge of the samples.

Laboratory specific access control

According to the interviewees, the access control is and should be organised by FM in consultation with the laboratories. FM manages the system and the laboratory managers determine who is allowed in the laboratories. The main reason for this is the knowledge and skills of both parties.

Building related maintenance

The maintenance of the building is usually provided by FM, possibly in conjunction with an external provider. Only at Organisation Z the laboratory employees are responsible for the building related maintenance. This is because Organisation Z has no FM department (yet). Both interviewees indicate this support service could be part of a FM support service offering in the future.

Laboratory-process-related maintenance

In contrast to the building related maintenance, most laboratories are responsible for the maintenance of the specific laboratory-process equipment. 6 of the 23 interviewees state that there is collaboration between FM and the laboratories for this support service. This collaboration is also how several interviewees like to organise this support service. There even are three interviewees who think FM should organise the laboratory-process-related maintenance. The reason that the laboratories should be in charge of the specific laboratory equipment is that they have to work with the equipment and are best able to judge when maintenance is necessary and at what time it should be done during their research processes.

Cleaning

In all the organisations FM is responsible for cleaning the building and therefore also for cleaning the laboratories. Cleaning is often outsourced to an external party with supervision of FM. In only two interviews, both within Wageningen UR, the respondents answered that the laboratories should be responsible for the cleaning of laboratories. One of them thinks the best solution is to establish a cleaning contract per laboratory. Arguing why FM could arrange this support service is because the general cleaning of the laboratory is mostly the floor and waste removal. Laboratory employees have

the responsibility to clean up after their work in the laboratories, because of the use of chemicals and other materials.

Laboratory glassware cleaning
This support service is carried out in many different ways in the organisations and in most cases the laboratories are responsible. However, the results of the question how this support service should be organised show that most respondents think FM should organise the cleaning of the laboratory glassware. This is due to the efficiency and cost savings that could occur.

Managing laboratory supplies
At the moment, most laboratories are responsible for the laboratory supplies, sometimes in collaboration with FM. However, controversy exists about how the support service should be organised. The general laboratory supplies could be managed by FM, if provided with no or minimal additional costs. However, there will always be specific laboratory supplies that should, according to the interviewees, be ordered by laboratory employees, because specific knowledge and expertise is needed for this.

Managing chemicals
The responsibility for the chemicals is in most cases a collaboration between FM and the laboratories or it is entirely placed within the laboratories. Regarding this collaboration; this usually means that FM receives and registers the chemicals before they go to the laboratories. The majority of the interviewees think FM should have a role in managing the chemicals or should be completely responsible for the support service. The main reasons for this are that FM is a central department, which could arrange an overview of all the chemicals in the building. A central registration eliminates risks and also safety has a major role when it comes to the organisation of this support service.

Managing laboratory gasses
In most cases FM is responsible for managing the laboratory gasses and, according to the interviewees, this should stay this way. It was indicated that most gasses are standard and have protocols. Therefore it is easy to 'outsource' this support service to FM according to the interviewees. When it comes to specific gasses, laboratories would like to manage these themselves.

Chemical waste
The last support service is chemical waste, where there is a clear division between FM and the laboratories as organisers. However, most interviewees would like FM to handle this support service, because of practical reasons and reducing risks. But the FM employees need additional knowledge and skills to handle chemical waste.

6.6 MISSING SUPPORT SERVICES

At the end of both the interviews and the questionnaire there was one final question focussed on possible support services the respondents missed in this research. Table 15 (on the next page) gives an overview of the answers from the interviews and questionnaire, including the number of times a support service was mentioned. There were five support services mentioned several times in both the interviews and the questionnaire. These support services were also mentioned by respondents from two or more of the four peer organisations. These five support services are:
-   *Laboratory coats:* this relates to the presence of clean laboratory coats.
-   *Technical support/service:* this is aimed at technical department for small equipment maintenance and building (small) test arrangement.

- **ICT:** according to the respondents, laboratories have different ICT support needs, which are often not taken into account by the ICT-department.
- **Different waste streams:** besides the chemical waste stream included in this research, laboratories may need other waste facilities focused on waste of genetically modified organisms (GMO) or medical waste.
- **Financial administration:** this support service is related to ordering laboratory supplies. After an order is placed by a laboratory employee, the financial department must approve the order. This is, according to respondents, a slow system which delays the processes in the laboratories.
-

Missing support services	Times mentioned	In interviews	In questionnaires
Advisory role	2	WUR - FM	
Courier services	1	WUR - FM	
Laboratory coats	8	WUR-FM (3); WUR-lab (1); X-lab (1); Z (2)	WUR
Nitrogen supply	1	WUR-FM	
Technical support/service	6	WUR-FM	WUR (2); X (2); Y (1)
Post handling	2	WUR-lab	WUR
ICT	6	WUR-lab; X-lab; Y-lab	WUR (3)
Different waste streams (i.e. GMO, hospital waste)	8	WUR-lab (1); Y-lab(1)	WUR (5); X (1)
Projects	1	X-FM	
Financial administration	5	Y-lab (3)	Y; WUR
Front office	1		Z
Registration system (goods & chemicals)	3		X
Additional (temporary) storage	3		WUR (2); X (1)
Goods receipt & distribution	3		WUR (1); X (3)
Cleaning	3		WUR (1); X (2)
Support during malfunctioning	2		WUR
Maintenance	2		WUR
Analysis capacity	2		WUR; Y
Equipment overview	2		WUR; X

Table 15: Missing support services

7. CONCLUSION AND DISCUSSION

The objective formulated for this research was to *provide an evidence-based decision about what facility service requirements FM should meet in the support of the laboratories in order to achieve a fit, by comparing the FM added value as assessed by users of comparable laboratories.* This final chapter will combine the information from the literature study and the results from the empirical study to formulate the requirements the support of laboratories should meet.

The first paragraph of this chapter provides the conclusions of this research in conjunction with the discussion points (7.1). During the execution of this research, a number of limitations have emerged which will be discussed in the second paragraph of this chapter (7.2). The last paragraph will give recommendations to Wageningen UR and for further research (7.3).

7.1 CONCLUSIONS AND DISCUSSIONS

In this paragraph the results of this research are used to draw conclusions. In addition, the discussion points that arise from these conclusions will be discussed. The conclusions described in this paragraph form the answer to the general research question. Since a lot of information must be combined in order to draw these conclusions, this paragraph is divided in several sub-paragraphs. First the conclusions of the response and non-response will be discussed (7.1.1). Then conclusions are drawn about the information obtained from the option 'not applicable' in the questionnaire (7.1.2). Third, the conclusions from the descriptive statistics are given (7.1.3). Thereafter, conclusions will be discussed about the differences between the four organisations (7.1.4). Conclusions about the support service requirements were also drawn (7.1.5). The final sub-paragraph is focused on the conclusions about organising support services for laboratories (7.1.6).

7.1.1 RESPONSE AND NON-RESPONSE

The dataset of the questionnaire showed three groups of outliers. One group were respondents who did not work in laboratories, but filled out the questionnaire anyway. Other respondents only filled in a few or half of the questions after which they ended the questionnaire program. The questionnaire started with a number of demographic questions. Part of the respondents answered none or only few of these questions and then stopped the questionnaire program. A possible reason for this is that the respondents did not want to provide this information, for example due to privacy reasons. Another possibility is that these respondents thought this information was not necessary for this research. The third group of outliers answered only half of the questions about laboratory support services. These questions were divided into two parts in the questionnaire program. It might be possible that, according to these respondents, the questionnaire was too long. There might be other reasons for this group of outliers to stop the questionnaire program, for example the questions were unclear to them, a lot of the questions did not apply to their laboratory work or the items in the questionnaire were not important enough to give their opinion on.

Besides the outliers found in the dataset, there were also employees who did not respond to the questionnaire at all. Part of this non-response can be explained by the fact that the questionnaire was also sent to employees who do not use laboratories during their work. Other reasons for this non-response were vacations and leave, indicated by out of office replies. Non-response could also be due to lack of time, the research topic was not important enough or employees receive a lot of requests to participate in (graduation) researches and are therefore unresponsive.

From this (non-)response and the resulting dataset, a few discussion points arise. First of all, it is possible that only the laboratory employees who think FM laboratory support is important responded to the questionnaire. This may cause a distorted image about the assessment of the laboratory support services. For example, an item scored a low average, because only the employees with a negative opinion filled out the questionnaire. The total response rate was set at nearly 20 per cent. Since the questionnaire was sent to more employees than only the laboratory employees, this response rate is actually higher. With a response rate above 20 per cent, we assumed the results of the questionnaire were representative for the laboratory employees of the peer organisations.

Furthermore, there were large differences in the number of respondents per organisation. The total dataset was dominated by Wageningen UR. Conclusions about the total dataset are therefore influenced strongly by Wageningen UR. If possible, conclusions were not only drawn based on the total dataset, but also for the separate organisations.

7.1.2 OPTION 'NOT APPLICABLE'

Four of the twenty items (i.e. accuracy of sample information, availability of sample information, preparation of samples, and availability of gasses) in the questionnaire had a substantially lower response than the other items. There can be several reasons for this lower response. For instance, the support services related to these items are not offered to the laboratories by a FM department and are therefore not applicable. Or the support services are not used in the laboratories and thus not applicable. Another possibility for the lower response is that the items are not important to the respondents and they do not have an opinion about the items.

For two of the support services with a low response rate, i.e. track and trace and sample preparation, the interviews showed that these support services are not needed in the laboratories or the laboratory employees arrange these themselves. The interviews, however, also showed a difference when it comes to these support services and the type of work done in laboratories. Organisations (or departments) with a focus on scientific research receive a relatively low amount of samples. Therefore it is not needed to track them during the research processes. In addition, sample preparation is part of the research process and therefore considered as part of the core business of these organisations (or departments). It is seen as a risk if the sample preparation is not performed by a laboratory employee. In contrast, organisations (or departments) that focus on analytical research work receive large amounts of samples which should be prepared in the same way before the analytical process starts. These organisations have a separate sample preparation department for this. For these laboratory employees it is beneficial if they do not have to do all the sample preparations themselves. Furthermore, for these organisations (or departments) it is very important to track the samples during the analytical process, because of the major interest that come with these analyses (i.e. killing of livestock). This suggests there are different needs and requirements in terms of service support for different laboratory departments. Concerning the support service managing laboratory gasses, the interviews indicated that for most of the gasses there are protocols. For this support service it appears that the fewer respondents came from the lack of opinion of the laboratory employees.

Regarding the four items with a higher response than the other items (i.e. indoor climate, maintenance conditions, cleanliness of laboratories, and safety of laboratories), there can be concluded that the corresponding support services are commonly used by the laboratory employees. The laboratory employees gave their opinion about these items, so possibly these items are important for the work in laboratories. Therefore it is a requirement to include these items and corresponding support services in the service support offering for laboratories. If these support services are organised in a proper way, it might be a benefit for the laboratories. The specific requirements and the preferred organiser of those support services cannot be concluded.

Going to the descriptive statistics, it was found that in the four organisations included in this research different types of research work is done. Wageningen UR is difficult to interpret in this research, since various departments participated in this research. These departments mainly focus on scientific research, but some departments carry out analytical research. Organisation Y is an organisation focused on scientific research, while Organisation X aims at research and development, and Organisation Z carries out analytical research work. These different types of research work go together with different functions and hours spent in the laboratories. The laboratory employees of Organisation Z are mainly analysts who spend a lot of time in the laboratories; i.e. almost the entire workweek, while Organisation X mainly has developers who spend little time in the laboratories. Within Organisation Y, the laboratory employees spend also relatively little time in the laboratories, but these employees are mostly PhD candidates and researchers. Because various departments of Wageningen UR participated in this research, the type of employees and the hours spend in the laboratories are distributed over the different possible answers.

In addition to these differences between the organisations, there were also clear differences in the average scores given to the 20 questionnaire items. The average scores for the items in the total dataset were between 5 and 6 on a 7-point scale. From this it can be concluded that the provided FM support to the laboratories is of high quality at this moment. However, when zooming in on the different organisations, there are clear differences. Organisation Y had the highest average scores between 5.78 and 6.40. Wageningen UR also scored high, with average scores between 4.93 and 6.01. These organisations have one thing in common; both organisations are scientific research organisations. It might be possible that the employees of this type of organisation are less demanding and therefore the average scores are higher. Another possibility is that the support service offerings are just better organised in these organisations at the moment, compared to Organisation X and Organisation Z.

Regarding the other two organisations, Organisation Z scored averages lower than the averages of the total dataset with average scores between 3.80 and 5.88. There might be several reasons for this. For instance, this organisation does not have a FM department, so laboratory employees have also FM related tasks. It might be possible that because of this the support for the laboratories is not well organised and because of the growth of the organisations this does not fit with the needs and requirements of the organisation anymore. Another possible explanation is that the employees of Organisation Z spent relatively much time in the laboratories. Therefore they might have higher demands when it comes to the support of the laboratories.

The average scores of Organisation X were variable: some are equal to the average of the total dataset, but others are much lower than the average of the total dataset. The average scores are between 3.97 and 6.19. Apparently, a number of support services are well-organised at the moment, but some support services are not arranged at a satisfying level or do not meet the needs and requirements of the laboratory employees. It might be possible that for this type of research some support services have a higher priority than other support services. The laboratory employees might have assessed the important support services lower than the support services that are less important to their work in the laboratories.

Regarding the first 7 items of the questionnaire (i.e. traceability of samples, availability of sample information, accuracy of sample information, sample storage, sample preparation, temperature conditions of equipment, authorized access), there were relatively few differences between the organisations in relation to the other 13 items of the questionnaire. For this, various reasons can apply. For instance, the support services related to the items are not often used in the laboratories

and therefore the employees do not have a strong (positive or negative) opinion about it. Another possibility is that the items are not important to the respondents and they do not have a strong opinion. 6 of the 7 items are focused on samples, something that was indicated as part of the core business during the interviews. Possibly the laboratories do not use support services related to the samples often and therefore the employees might care less about these support services. The other item is focused on laboratory access. Apparently there are no significant differences in opinion about this support services between the four organisations.

In the second part of the item list there were many differences between the organisations and these differences are also large. The items included in this part of the item list are; indoor climate, maintenance conditions, functionality of equipment, cleanliness of laboratory, availability of clean glassware, cleanliness of glassware, timely availability of laboratory supplies, timely availability of chemicals, accuracy of chemical registration, timely availability of gasses, chemical waste removal, swift intervention in the event of disruptions, laboratory safety. These items focused on equipment and supplies for laboratories that are required to work in the laboratories. The laboratory employees clearly had an opinion about these items and the opinions differed per organisation. Apparently, there are differences in the quality perception between the laboratory employees of the four organisations. The cause of these differences in quality perception cannot be specified with certainty.

Remarkable is the high number of differences between Wageningen UR and Organisation Y (60%). These two organisations scored the highest averages of the four organisations. In addition these organisations are both focused on scientific research. Nevertheless, Organisation Y scored higher for almost all items with significant differences from 0.5 or more compared to Wageningen UR. It can be concluded from this that the FM support service offering within Organisation Y is assessed best by the end users of the laboratories. However, what is causing the differences in opinion between these organisations cannot be stated with certainty. Some support services are organised in a different way within these organisations, but other support services are in fact organised in the same way. This suggests that the way a support service is organised might not be the decisive factor for the respondents when assessing a support service. Another aspect in this research was the alignment between FM and the laboratories. The method of alignment in these two organisations differs. Organisation Y has a facility desk that the employees can communicate their problems with. Besides this, if necessary, there is direct communication between the laboratory employees and the FM department. If there is a structural problem, this is first reported via the facility desk system. If necessary, a meeting or a project group is established with employees from the laboratories and the FM department. Within Wageningen UR, the communication between FM and the laboratories is mostly direct and in some cases a facility desk is used. However, structural problems are communicated directly or discussed in the laboratory-committee. FM is, most of the times, not involved in this laboratory-committee. This could potentially lead to misalignment and cause the lower assessment of the items in the questionnaire compared to Organisation Y.

Between Organisation Y and Organisation Z there was also a high number of differences (60%). This high number of differences was expected, based on the averages per item. There can be several reasons for these differences in the assessment. For instance, the laboratory employees of Organisation Z have higher demands when it comes to support services, because they spend relatively much time in the laboratories. As a result, they assessed the items with lower scores. Another possibility is that because of the type of work done by Organisation Z, the employees have higher support service demands and this caused the lower assessment. Last but not least, Organisation Z currently has no FM department. Because of this, support services might not be well organised at the moment which may lead to a lower quality assessment.

Also the significant differences between Organisation X and Wageningen UR and Organisation Y were expected based on the averages per item of these organisations. Apparently certain items scored

well within Organisation X and other items scored relative low averages. This can be caused by the type of work done within this organisation. This type of work might have specific requirements.

Sub-paragraphs 7.1.3 and 7.1.4 showed that there are differences between the four organisations and the items are assessed differently by the laboratory employees. However, it cannot be concluded with certainty what caused these differences in assessment. Possibly the different types of research and related work require other FM support service offerings. Although, the differences in the average scores could also occur because of how the current support services are organised.

The literature study showed a distinction in core business activities and other activities. After the empirical research, the question arose if it is possible to determine the activities that belong to the different categories in the model of Arnold (2000). The differences between the organisations showed a distinction in the items; there was a group of items with many differences and a group with a few differences. From this, it may be concluded that the items with few differences are already well organised in the four organisations and meet the requirements of the laboratory employees. Possibly, these support services are already well organised, because they are important to the laboratories. These support services and related activities could be the core-close activities of the laboratories. The interviews showed that these items, related to samples, are indeed core-close activities or in some cases core business activities. This confirmed the importance of these items for the work in the laboratories. However, since the research was not designed to investigate this specifically, it cannot be said with certainty if this classification is correct. Further research is needed to draw a substantiated conclusion.

7.1.5 SUPPORT SERVICES REQUIREMENTS

The four factors (i.e. sample handling and conditions, handling laboratory supplies and laboratory safety, availability of glassware and gasses and cleanliness of laboratories and glassware, and system maintenance) included in this research explain almost 35 per cent of the assessment of the quality of facility services overall. In addition, the factors explain two-third of the assessment of the contribution of facility services to the work in laboratories. The factor handling laboratory supplies and laboratory safety had the highest influence on the quality of facility services overall and the contribution of facility services to the work in laboratories. All the items in this factor had an average or high number of respondents and were included in the group of items with many significant differences between the organisations. The items were already indicated as important to the laboratory employees in previously formulated conclusions. Therefore, it can be concluded that support services and items related to handling laboratory supplies and laboratory safety should be organised well in order to support a laboratory work environment. This will be perceived as a benefit by the laboratory employees. Previously formulated conclusions showed that FM and laboratories should align the needs of the laboratories and the requirements of the services FM is offering, since various factors could affect the assessment of the support services (i.e. type of work done in the laboratories or type of organisation).

A remarkable difference between the total dataset and the data obtained within Wageningen UR, is the influence of the factors on the quality of facility services overall. The three significant factors (i.e. handling laboratory supplies and laboratory safety, availability of glassware and gasses and cleanliness of laboratories and glassware, and system maintenance) explain more than 75 per cent of this within Wageningen UR. These factors explain more of the assessment of the quality of facility services overall than the contribution of facility services to the work in laboratories; this is in fact 70 per cent. From this it can be concluded that employees of Wageningen UR working in laboratories consider the items and corresponding support services in this research as highly important. Other FM

support services, which have no effect on the work in laboratories, determine only one-fourth of the assessment of the quality of facility services overall. In order to support the laboratory employees during their work, the FM department should not make any concessions in terms of quality for the items of the significant factors found in this research. This requires that the corresponding support services need to be properly organised in order to support the laboratories.

Just as in the overall dataset, the factor focused on handling laboratory supplies and laboratory safety had the highest influence on the quality of facility services overall and the contribution of facility services to the work in laboratories. Apparently, the support services within this factor are of high importance to the work in laboratories. Support services in this factor are managing chemicals, managing laboratory supplies, and chemical waste. Besides this, items in this factor not related to specific support services are swift intervention in the event of disruptions and safety of the laboratory. These support services and items must be well organised in the support service offering of the Wageningen UR FM department. If these support services and items are well organised, this will be beneficial for the laboratories of the organisation. Again, alignment between FM and the laboratories is needed, in order to determine how the support services should be organised. The factor with no statistically significant output, focused on the samples, is not important since the employees consider this as core business and prefer to arrange this themselves as emerged from the interviews. According to the interviewees it is a risk if this is not performed by someone with a laboratory background.

Referring to the model of Arnold (2000), laboratory employees of Wageningen UR mentioned in the interviews that all activities with samples are core business activities. The results show that, for this organisation, support services related to samples did not have a significant effect on the dependent variables. This could be explained by the fact that, according to the employees, these support services do not belong to facility services, as both dependent variables are aimed at this. Furthermore, the factor with the most influence on the quality of facility services overall and the contribution of facility services to the work in laboratories focused on safety in the laboratories and various supplies for the laboratories. It is a requirement that those support services are included in the service support offering, since the laboratory employees could not do their work without these services. Therefore it may be concluded that items in this factor are so called core-close activities. Items and corresponding support services of the remaining two factors affect the assessment of the service support, but significantly less. Therefore, these items might be core distinct activities. Again, since the research was not designed to investigate this specifically, it cannot be said with certainty if this classification is correct. Further research is needed to draw a substantiated conclusion.

7.1.6 ORGANISING SUPPORT SERVICES

The research indicated different ways in which support services could be organised, namely FM, the laboratories, a combination between FM and the laboratories, or outsourced to an external provider. The support services with the highest influence on the quality of facility services overall and the contribution of facility services to the work in laboratories are managing chemicals, managing laboratory supplies, and chemical waste (i.e. factor 2 in the regression analyses). If we take a closer look at the way these support services are organised in the different organisations, we discovered differences. Within Organisation Y and Organisation Z these support services are organised by the laboratories, while at Wageningen UR there is a combination between FM and the laboratories for managing laboratory supplies and chemicals and FM organises the chemical waste. At Organisation X FM organises the laboratory supplies and chemicals and the removal of chemical waste is outsourced to an external provider. The assessment of the related items had the highest averages when the laboratories organised the support service (Organisation Y and Organisation Z). Thereafter, Wageningen UR was second best with the organisation by FM or a collaboration between FM and the

laboratories. For all items, Organisation X was assessed with the lowest average. Organisation X aside, the averages of the other three organisations were close together and all above 5 and thus sufficient.

When looking at the way the three support services (i.e. managing chemicals, managing laboratory supplies, and chemical waste) are organised compared to the averages, differences arise in the assessment. When FM organised a support service, this was assessed with an average of 4.89. While if the laboratories organise a support service, this was scored with an average of 5.74. A combination between FM and the laboratories was assessed with an average of 5.59. Only one of the support services was outsourced by one of the organisations and this was assessed with an average of 4.75.

In reasoning, the laboratories as organisers were assessed best followed by the combination between FM and the laboratories. The average scores of these two are close together. From this it can be concluded that it is a requirement that the items and related support services are organised by the laboratories or a combination between FM and laboratories in order to support laboratories in the best possible way. This is consistent with the conclusion that alignment is important in the service support of laboratories, since there should be a good alignment between FM and the laboratories in order to organise a support service together.

The four organisations perform other laboratory work focused on scientific research, development research, and analytical research. The needs and requirements of a specific type of research may affect the assessment of the items in the questionnaire. Therefore, the previously drawn conclusions could be affected by this. To make sure that the way a support service is organised has little to no impact on the assessment of the support service, organisations with a similar research focus should be investigated.

7.2 LIMITATIONS

The literature and empirical study contained some limitations that should be acknowledged. These limitations will be discussed in this paragraph.

This research focused specifically on support services for laboratories. However, respondents of the questionnaire also use other support services. Possibly their opinion about these other support services had an influence on the results of this research. By stating, multiple times, that the research focused on support services for laboratories, we attempted to minimize this influence. Despite this limitation, the results of this research showed that the correct items were used to assess laboratory services support, since they explained more than two-third of the variance of the contribution of facility services to the work in laboratories.

Furthermore, interviews were held at both the laboratory and the FM side. It might be that the facility managers have not been entirely objective about the support service offering of their FM department. Problems with the current support service offering may not be discussed in these interviews. By also interviewing laboratory managers, we tried to obtain as much information as possible about the current service support for laboratories. In addition, the assessment of the support services was done by end users and not by FM employees.

And last but not least, costs are part of the FM added value trade-off. However, costs were not part of this research. Costs could play a role when determining the provision of support services. In order to provide a proper answer to the research question, costs of the support services in relation to the added value of FM should be investigated.

7.3 RECOMMENDATIONS

From the conclusions and discussions, recommendations can be formulated for both Wageningen UR as the commissioning organisation and for further research regarding this topic. These recommendations are presented in this final paragraph. First the recommendations for Wageningen UR will be discussed (7.3.1). Afterwards the recommendations for further research will be given (7.3.2).

7.3.1 RECOMMENDATIONS FOR WAGENINGEN UR

The current support service offering of Wageningen UR FM department for the laboratories was assessed as good. In order to support the laboratories even better in the future, it is recommended that the FM department does not make any concessions in terms of quality when it comes to managing chemicals, chemical waste, managing laboratory supplies, the swift intervention in the event of disruptions, and laboratory safety. Hereby, it is important to realize this not only contributes to the assessment of the support services for laboratories. It has an even greater impact on the assessment of the quality of facility services overall by the laboratory employees. Besides this, when focusing on establishment of this, it is not about how this is organised. More important is the alignment between FM and the laboratories.

Support services for laboratories that also should be well organised are: cleaning, laboratory glassware cleaning, managing laboratory gasses, building related maintenance, laboratory-process-related maintenance, and the laboratory specific access control. However, these support services have a significantly lower impact on the assessment of the service support overall and for the work in laboratories then the previously mentioned support services. Also for these support services it is important that FM aligns with the laboratories when determining the specific service requirements.

The support services focused on samples (i.e. sample reception & administration, sample storage, sample preparation, track & trace, and temperature registration) do not have the priority in the support of the laboratories within Wageningen UR. The factor with the items related to these support services had no proven significant effect on the assessment of FM. This was confirmed by the interviews, which indicated that these support services are either not applicable or part of the core business and therefore, according to the interviewees, it is not possible for FM to arrange them.

In order to optimise the service support for laboratories even more, research can be done focused on the different types of laboratories within the organisation. Most of the departments of Wageningen UR focus on scientific research. However, there are also some departments focused on analytical research. This research showed that different types of laboratories possibly need other types of services support. However, more research should be done to confirm this and also draw more comprehensive conclusions.

7.3.2 RECOMMENDATIONS FOR FURTHER RESEARCH

During this research, several possibilities for further research regarding this topic emerged. These possibilities will be discussed in this sub-paragraph.

This research is a start in the investigation of the possibilities FM has in supporting the laboratory work environment and to determine how FM can add value to the work in laboratories. This research showed that the items, subtracted from the support services, have an effect on the assessment of the overall facility services and the contribution of facility services to the work in laboratories. Also, this research showed differences between the included organisations when it comes to type of work done in the laboratories, time spent in the laboratories, and the way FM is organised in the

organisations. Furthermore, the research showed statistically significant differences in the assessment of the different studied items. Unfortunately, the response rates of three of the four investigated organisations was too low, partly due to the N/A option in the questionnaire, to fully analyse these organisations. In order to support laboratories in the best possible way, it is interesting to do more research focused on the service requirements for different types of laboratories. For example, an organisation with more analytical routine work, where a lot of time is spent in the laboratories, might need another support service offering than an organisation focused on new developments. So other service requirements might be needed in different types of laboratories. Unfortunately, this research could not answer these questions.

In addition, this research provides a first start in the distinction between core close and core distinct activities. However, this research was not designed to investigate this. For further research, it might be interesting to investigate what activities associated with laboratories are core business, core close, and core distinct. Maybe this makes it possible to determine even better the focus of alignment and service requirements for laboratories.

Besides this, one aspect of FM added value was not included in this research, namely cost. To draw complete conclusions regarding the requirements the support of laboratories should meet, this aspect should also be investigated in further research.

In addition, there was no information found in the literature study about support service offerings for laboratories. Therefore we used the knowledge of Wageningen UR to establish a list of support services that could be offered to a laboratory. To make sure no important support services were missing in this research, in both the interviews and the questionnaire there was asked if respondents missed any support services within the research. This resulted in a number of support services that were mentioned in both the interviews and the questionnaire and by several of the organisations. Support services that were mentioned were:

- *Laboratory coats:* ensuring that there are enough clean laboratory coats available;
- *Technical support:* the technical support service for small equipment malfunctions to prevent the need to get expensive maintenance. But also for the set-up of (small) test arrangement;
- *ICT:* laboratories have additional needs and requirements when it comes to ICT and this is often little or not taken into account, because there is one general ICT service department.
- *Different waste streams (besides chemical waste):* this research only looked at chemical waste as a specific laboratory waste stream, but there are also other specific waste streams such as GMO waste and hospital waste that are important when supporting laboratories.
- *Financial administration:* this focuses on ordering laboratory supplies. Before an order is sent to the supplier, the financial department must approve it. This could cause delays in the delivery process and thus could cause delays in the research processes of the laboratories.

For future research it is important to include these missing support services in order to get an even better picture of the FM service requirements needed to add value to the laboratory work environment.

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Theorectical review

Empirical study

Conclusion

Scope of FM
RQ1

Characteristics lab. support
RQ2

Peer organisations

Conclusion

FM added value
RQ3

Analysis

Recommendations

Alignment/Fit
RQ4

RQ5 & RQ6
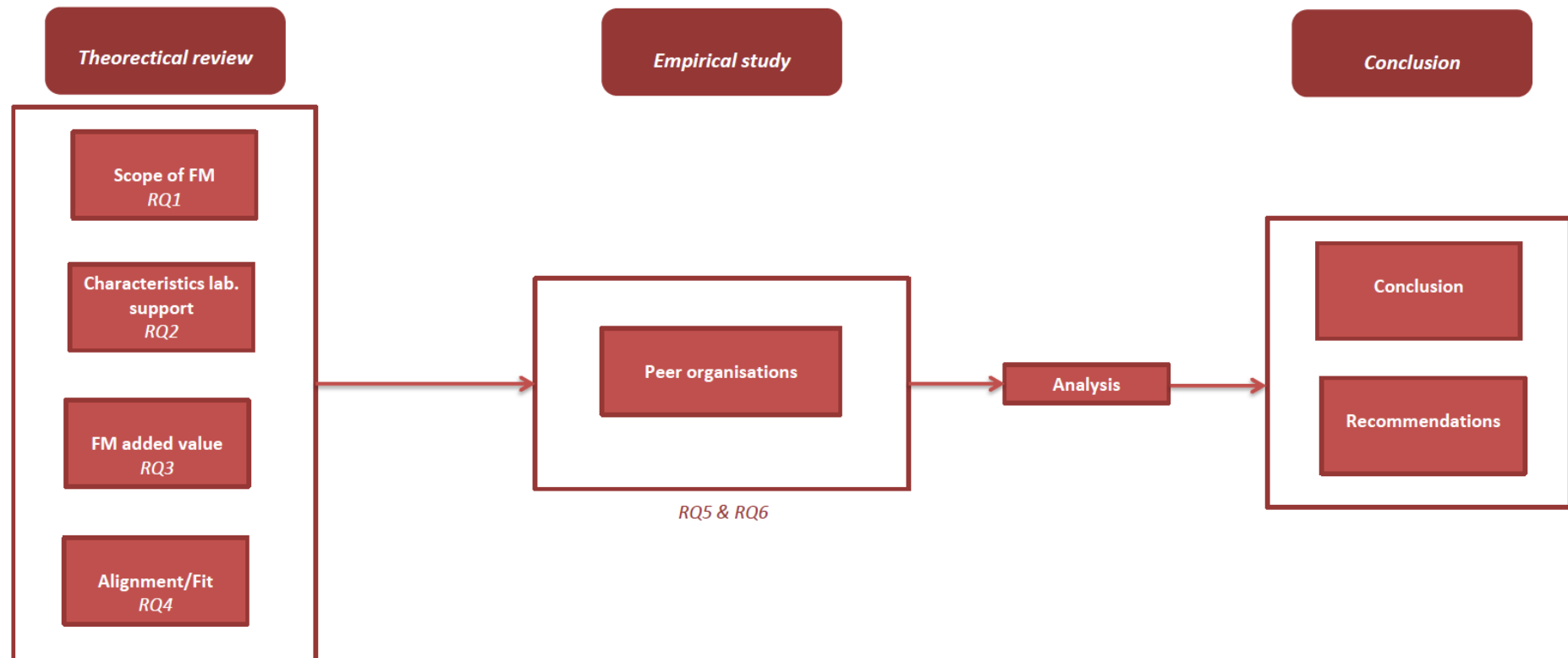
APPENDIX II – CURRENT (TEMPORARY) SITUATION LABSUPPORT (DUTCH)

Het pakket labondersteuning bestaat uit alle producten en diensten die ondersteunend zijn aan het onderzoek dat in laboratoria wordt uitgevoerd. Deze producten en diensten worden verrekend o.b.v. m2 FNO. Deze kosten zijn gedekt in de post functioneel gebouwbeheer. Het FB bestelt op de kostenplaats van het organisatieonderdeel, het organisatieonderdeel is eigenaar van de goederen en het FB beheert de voorraad.

Beheer labgassen
Omschrijving
Basis:
Het in ontvangst nemen, opslaan en distribueren van labgassen.

Aanvullend:
Het beheer van het gasnet, controle van het gasnet en bestellen van labgassen (voorraadbeheer), waaronder gasvormige stikstof.
Controleren van gasflessen op het lab.
Het uitvoeren van deze dienst buiten kantoortijden en werkdagen (storingsdienst)

Maatwerk:
Omdat er een bepaalde proef is wordt de frequentie van de controle tijdelijk opgevoerd.

Service level
Tijdige beschikbaarheid van labgassen en een veilig en goed werkend gasnet.

Aanvraag/wijziging/afmeldprocedure
Aanvragen voor aanvullende en maatwerk dienstverlening gaan via de Locatiemanager.

Beheer vloeibaar stikstof
Omschrijving
Basis:
Het bewaken en controleren van de voorraad middels telemetrie (aparte tank voor vloeibaar stikstof).

Aanvullend:
Het uitleveren van vloeibaar stikstof in de daarvoor bestemde vaten.
Controle van stikstofvaten op het lab.
Het uitvoeren van deze dienst buiten kantoortijden en werkdagen (storingsdienst).

Maatwerk:
Omdat er een bepaalde proef is wordt de frequentie van de controle/aflevering tijdelijk opgevoerd.

Service level
Tijdige beschikbaarheid van vloeibaar stikstof.

Aanvraag/wijziging/afmeldprocedure
Aanvragen voor aanvullende en maatwerk dienstverlening gaan via de Locatiemanager.

Beheer labjassen

<u>Omschrijving</u>

Basis:

Het voorzien in schone labjassen voor labmedewerkers op maat en het beheren van de voorraad (overzicht van de in omloop zijnde jassen).

Aanvullend:

Labjassen voorzien van afdelingsnaam/medewerker naam en logo Wageningen UR of organisatieonderdeel en kleurcodering.

Maatwerk:

Evt. leveren van extra labjassen t.b.v. bezoekers.

<u>Service level</u>

Tijdige beschikbaarheid van schone en het correcte type labjassen.

<u>Aanvraag/wijziging/afmeldprocedure</u>

Labjassen worden de medewerkers beschikbaar gesteld via het magazijn.

Aanvragen voor aanvullende en maatwerk dienstverlening gaan via de Locatiemanager.

Chemicaliënbeheer

<u>Omschrijving</u>

Basis:

Het ontvangen, controleren, registreren in EBS, en indien nodig tijdelijk opslaan en uitgeven van chemicaliën (registratie in GROS).

Aanvullend:

Voorraadbeheer en opslaan van chemicaliën in een magazijnruimte.

Het bestellen van de chemicaliën ten behoeve van de voorraad.

Interne distributie van chemicaliën en registratie hiervan in GROS.

Maatwerk:

Tijdelijke hogere voorraad of tijdelijk andere type chemicaliën op voorraad nemen.

<u>Service level</u>

Ontvangst, controle, registratie en uitgifte vindt plaats conform de daarvoor geldende richtlijnen (nog specificeren welke).

<u>Aanvraag/wijziging/afmeldprocedure</u>

Registratie vindt plaats in EBS (binnenboeken) en GROS (registratie).

Aanvragen voor aanvullende en maatwerk dienstverlening gaan via de Locatiemanager.

Meldingen over de dienstverlening kunnen doorgegeven worden aan de Servicedesk FB.

Storingsdiensten

<u>Omschrijving</u>

Basis:

Controle rondes gebouw, alarmopvolging.

Aanvullend:
Controle op het lab t.b.v. eerder genoemde diensten (stikstof, gas etc.)
In ontvangst nemen goederen/monsters ten behoeve van laboratoria.
Alarmopvolging op temperatuurregistratiesysteem.
Maatwerk:
Openen gebouw in het geval van crisis.

Service level
Tijdige opvolging bij alarm (binnen een half uur).

Aanvraag/wijziging/afmeldprocedure
Aanvragen voor aanvullende en maatwerk dienstverlening gaan via de Locatiemanager.

Spoellokaal
N.B. Het is nog de vraag of deze dienstverlening door het FB wordt aangeboden.

Omschrijving
Basis:
Het ophalen, reinigen en terugbezorgen (op hetzelfde lab) van labglas.

Aanvullend:

Maatwerk:

Service level
Beschikbaarheid van tijdig en correct gereinigd labglas.

Aanvraag/wijziging/afmeldprocedure
Aanvragen voor aanvullende en maatwerk dienstverlening gaan via de Locatiemanager.
Meldingen over de dienstverlening kunnen doorgegeven worden aan de Servicedesk FB.

Inzameling en verwijdering van glasafval
Omschrijving
Basis:
Het op afroep inzamelen en verwijderen van labglas. Er zijn op centrale plekken inzamelingsbakken aanwezig.

Aanvullend:
Het op afroep inzamelen en verwijderen van chemisch verontreinigd labglas.

Maatwerk:
-

Service level
Correcte afvoer van glasafval en chemisch verontreinigd glasafval conform de daarvoor gelende richtlijnen en procedures.

Aanvraag/wijziging/afmeldprocedure
Aanvragen voor aanvullende en maatwerk dienstverlening gaan via de Locatiemanager.

Inzameling en verwijdering chemisch afval

<u>Omschrijving</u>
Basis:
Het inzamelen, rubriceren, opslaan en aanbieden aan afvalverwerker van het chemisch afval conform de daarvoor geldende richtlijnen en procedures. Onder chemisch afval wordt verstaan: ziekenhuisafval, biologisch materiaal, chemicaliën.

Aanvullend:
Het inzamelen, rubriceren, opslaan en aanbieden aan afvalverwerker van chemisch afval anders dan hierboven is vermeld.
De aanvullende werkzaamheden worden pas uitgevoerd als hiervoor een schriftelijke opdracht is verstrekt via de locatiemanager.

Maatwerk:
Hiervoor wordt een aparte offerte opgesteld moeten worden. Enkele maatwerkdiensten zijn:
Plaatsen en ledigen van extra containers bij evenementen of calamiteiten;
Opstellen specifieke rapportages m.b.t. afgevoerd afval.

<u>Service level</u>
Het afval wordt periodiek opgehaald op centrale punten in de laboratoria. Voor het inzamelen van het chemisch afval worden voldoende containers, die voldoen aan de geldende richtlijnen, ter beschikking gesteld.
Meldingen over de dienstverlening en het materiaal voor inzamelen van het chemisch afval kunnen doorgeven worden aan de Servicedesk FB.

<u>Aanvraag/wijziging/afmeldprocedure</u>
Aanvragen voor aanvullende en maatwerk dienstverlening gaan via de Locatiemanager.

Beheer van lab benodigdheden

<u>Omschrijving</u>
Basis:
Het bestellen, ontvangen, opslaan, op voorraad houden en distributie van een aantal lab benodigdheden (bepaald door het organisatieonderdeel).

Aanvullend:
-

Maatwerk:
Het tijdelijk op voorraad nemen van lab benodigdheden anders in de 'normale' voorraad.

<u>Service level</u>
Tijdige beschikbaarheid en levering van de in voorraad zijnde lab benodigdheden.

<u>Aanvraag/wijziging/afmeldprocedure</u>
Goederen worden besteld in het Elektronisch Bestel Systeem (EBS).
Aanvragen voor aanvullende en maatwerk dienstverlening gaan via de Locatiemanager.

APPENDIX III – OLD SITUATION LABORATORY SUPPORT

Sample reception + administration

Purpose of the sample reception is to record the presence of the by RIKILT received and accepted samples in such a way that exchange of samples is prevented and required analysis can be performed in a controlled way. Several sample-parameters are set in consultation with the responsible project-leader.

- Providing of unique sample-number
- Sample pretreatment-info: grinding, milling, freeze-drying etc.
- Analysis to be performed
- Reporting format (by letter, e-mail, excel-file)
- Storage-info of samples (fridge, freezer, etc.)
- Storage time

Sample pre-preparation

Purpose of the sample preparation is to prepare received and accepted samples in such a way that the concerned laboratories are able to perform the requested analysis.

Grinding, milling, freeze-drying and production of homogeneous (sub)samples.

Sample storage

Storage, short- and long term, of all samples, in freezer, fridge or room-temperature.

Laboratory Management Information System (LIMS) Sample-registration, reporting and manual result-entry.

Purpose: registration of information about samples, test (to be) performed and the results.

Tracking progress of samples, reporting results.

LIMS application management

Laboratory Management Information System (LIMS) laboratory-automation

Purpose: automatic result-entry from lab-equipment into LIMS. Connection between LIMS and analysis-equipment.

LIMS application management

Track and Trace

Purpose: registration of storage-conditions, storage location and storage time (of sample-material).

Controlled disposal of sample-material.

T&T application management

MCPS: temperature-registration

Purpose: continuous registration and logging of temperature of a wide variety of lab-equipment (freezer, cooler, fridges, stoves etc.).

Alarm when out of specs (a.o. telephone).

MCPS application management

Access control (building general)

Purpose: controlled access to building (WUR-card) and restricted access to specific facilities.

WUR-card: card-reader for registration of presence to facilitate the In-house emergency and first-aid service

Central distribution of access-cards

Central application for registration (Invise)
RIKILT authorized to grant access to building

Access control (specific laboratories)
WUR-card (card-readers for a.o. sample storage-rooms)
Transponder (electronic keys for specific laboratories)
Normal key (for technical staff)
Central application for registration (Invise)
RIKILT-application for transponders (electronic keys)

Building management
Building management system (PRIVA)
Maintenance overview (list objects, actions, etc.)
FMIS (Planon)
Contracts with suppliers
Written procedures

Building-related maintenance:
Climate-control (heating, cooling, air-humidification)
Air change rate (the number of complete air changes per hour)
Fire-valves
Stand-by generator (generating set which is designed to supply essential auxiliary circuits during a loss of system supply)

Lab-process-related maintenance
Fume cupboards (close automatically)
Safety storage cabinets (close automatically)
Technical gasses (the system)
Compressed air
Demi-water
MCPS (temp. registration, incl. application-management)

Cleaning
Restricted access to ML-laboratories (cleaning in presence of lab-manager).
In some labs vaccination of cleaning-personnel is required.
Cleaning (floor covering test-samples "tapestry" during construction-time)

Cleaning laboratory glassware (central facility)
Glassware of each lab stays together
Wash and dry
Stove (super dry)

Post and archiving (paper)
Current situation
Documents   Paper <> digital
General   all incoming docs are digitized
Financial   only digital invoices
Personnel   file employees digitized (since 2005)
Project-info   all incoming paper is digitized

Sample-doc   some paper, some digitized
Methods   digitized
Results   digitized
Lab-journals paper
Discharging after time limit for storage (some 10 year)

Electronic Purchasing system
EBS, used by some 20 purchasers of all departments.

Purchasing and storage of lab-supplies and chemicals
Central purchasing, storage and supply of (some!) lab-supplies and chemicals

Technical gasses (the gasses, procedures, purchase and delivery, etc.)
Central supply of Oxygen, Argon, Helium, Carbon-dioxide, Oxygen, Nitrogen (tank 6400ltr), Liquid Nitrogen (tank 3200ltr)

Waste
Chemicals, glass, "household refuse", paper.
Central collection of chemicals, glass and paper by facilities-department
Chemical waste is temporarily stored in special storage. Classified by type of hazardous waste (every 4 – 6 weeks taken away)
Collection of "household refuse" by the cleaning company (domestic waste).

Catering
Coffee, tea, soup. Catering services for lunch-meetings etc.
No consumption allowed in laboratories.

General facilities (safety)
Reception: registration of visitors, alarm-phone-number
In-house fire-, emergency- and -first-aid service
man-down-system (or non-movement)
selective calling system (for first-aid)

Office-facilities incl. IT
Personal computer + network-connection
Personal account + e-mail-box
Storage (server, incl. backup & restore)
Telephone (voip, mobile)
Microsoft Office 2010
WUR-client (packaged software, including LIMS)
Multifunctionals (network-print, -scan, copy)
Access to network-shares for laboratory-data.

IT-Support for lab-specials
Totalchrom, LIMS, MCPS, NPK etc.
Network-shares for laboratory-data.

Office-facilities: Desk (in room outside laboratory)

Desk, preferably in direct neighborhood of laboratory (as it is not allowed to structurally do administrative work on the lab)

Office-cleaning.

APPENDIX IV – LABORATORY SUPPORT SERVICES (PARTLY DUTCH)

Monsterontvangst & -administratie

De monsterontvangst en monsteradministratie bestaat uit het in ontvangst nemen van monsters en het registeren ervan in het centrale systeem van het instituut. Hiermee wordt voorkomen dat monsters verwisseld worden of kwijt raken. In overleg met de verantwoordelijke projectleider(s) worden afspraken gemaakt over deze monsteradministratie wat betreft de volgende punten:

- De monsters worden voorzien van een uniek monsternummer
- De informatie voor de monstervoorbehandeling (zoals malen, zeven, vriesdrogen, etc.) wordt gekoppeld aan het monsternummer
- De uit te voeren analysen worden gekoppeld aan het monsternummer
- De manier van rapporteren (per attest, brief, e-mail, Excelbestand) wordt gekoppeld aan het monsternummer
- De opslaginformatie (koelkast, vriezer, etc.) van de monsters wordt gekoppeld aan het monsternummer
- De bewaartijden van de monsters wordt gekoppeld aan het monsternummer

- *Hoe beoordeelt u de <u>traceerbaarheid</u> van de benodigde monsters voor uw werkzaamheden?*
- *How do you evaluate the <u>traceability</u> of the samples required for your work?*

Track & trace

Deze dienst richt zich op het traceren en volgen van monsters vanaf binnenkomst tot vernietiging. De opslagcondities, –locaties en bewaartermijnen van originele monsters alsmede duplicaat- en contramonsters worden bewaakt en geregistreerd. Ook de (volgorde van de) handelingen tijdens de productie van de deelmonsters worden geregistreerd. Deelmonsters worden overgedragen vanuit monstervoorbewerking naar laboratoria: ook dit wordt vastgelegd.

- *Hoe beoordeelt u de <u>beschikbaarheid</u> van gegevens over uw monsters in het registratiesysteem, zoals moment van binnenkomst en welke handelingen er mee verricht zijn?*
- *How do you evaluate the <u>availability</u> of information concerning your samples in the registration system, such as time of entry and the actions that have been performed with the sample?*

- *Hoe beoordeelt u de <u>juistheid</u> van alle benodigde gegevens van de monsters in het registratiesysteem?*
- *How do you evaluate the <u>accuracy</u> of all the needed information of the samples in the registration system?*

Monsteropslag

De monsteropslag bestaat uit het opslaan van monsters, voor zowel de korte als de lange termijn, onder voorgeschreven condities (temperatuur en luchtvochtigheid) in bijvoorbeeld de vriezer, koelkast of op kamertemperatuur.

- *Hoe beoordeelt u de opslag van monsters <u>conform de voorgeschreven condities</u>?*
- *How do you evaluate the storage of samples <u>according to the required conditions</u>?*

Monstervoorbereiding

Bij deze ondersteunende dienst worden de monsters voorbewerkt voor het onderzoek, zodat de laboratorium medewerkers de beoogde analysen kunnen uitvoeren. De voorbewerkingen betreffen malen, zeven, vriesdrogen en de productie van homogene deelmonsters voor elke betrokken onderzoeksgroep.

- *Hoe beoordeelt u <u>het op de juiste wijze</u> voorbereiden van de monsters, mits uitgevoerd door iemand anders dan u zelf?*
- *How do you evaluate the preparation of the samples <u>in the correct way</u>, if carried out by someone else?*

Temperatuurregistratie

Van alle koelkasten, vriezers, (broed)stoven, verassingsovens en waterbaden wordt de temperatuur in een continue proces gemonitord. Wanneer een van de aangesloten apparaten buiten specificaties komt, wordt de apparaat-beheerder (of 's-nachts de storingsdienstmedewerker) telefonisch gewaarschuwd. Op deze manier wordt voorkomen dat waardevol (monster)materiaal verloren gaat en er wordt bewaakt dat de monsteropslag, de bewaring van gebruikte reagentia en de analysen aantoonbaar onder de voorgeschreven temperatuurcondities hebben plaatsgevonden.

- *Hoe beoordeelt u de <u>permanentie van temperatuurcondities</u> van apparatuur (o.a. koelkasten en vriezers) in uw laboratorium?*
- *How do you evaluate the <u>permanency of the temperature conditions</u> of equipment (such as refrigerators and freezers) in your laboratory?*

Laboratorium specifieke toegangscontrole

Deze dienst zorgt voor de gecontroleerde toegang tot laboratoria en beperkte toegang tot specifieke faciliteiten (zoals opslagruimten, specifieke laboratoria, etc.). Hierbij is de centrale distributie van toegang-kaarten en centrale aanvraag voor registratie inbegrepen.

- *Hoe beoordeelt u het <u>geautoriseerd toegang hebben</u> tot uw laboratorium?*
- *How do you evaluate the <u>authorized access</u> to your laboratory?*

Gebouw gebonden onderhoud

Deze algemene onderhoudsservice omvat sub-diensten die belangrijk zijn voor laboratoria. Hieronder valt onder andere het onderhoud aan de klimaatregeling (verwarming, koeling, en lucht-bevochtiging), het ventilatiesysteem, de brandkleppen en het noodstroomaggregaat. Deze dienst zorgt voor (half) jaarlijkse controle en onderhoud aan deze systemen en apparatuur.

- *Hoe beoordeelt u het <u>binnenklimaat</u> in het laboratorium in relatie tot uw werkzaamheden?*
- *How do you evaluate the <u>indoor climate</u> in the laboratory in relation to your work activities?*

- *Hoe beoordeelt u de <u>staat van onderhoud</u> van het laboratorium waarin u werkzaam bent (o.a. plafond, vloeren, muren, interieur)?*
- *How do you evaluate the <u>maintenance conditions</u> of the laboratory you work in (i.e. ceiling, floors, walls, interior)?*

Laboratorium-proces gerelateerde onderhoud

Deze dienst richt zich op het onderhoud van specifieke laboratoriumapparatuur, zoals bijvoorbeeld zuurkasten, chemicaliënkasten en systemen voor technische gassen, demiwater en perslucht. Er wordt gezorgd voor (half) jaarlijkse controle en onderhoud.

- *Hoe beoordeelt u <u>functionaliteit</u> van de specifieke apparatuur, zoals zuurkasten en chemicaliënkasten, in uw laboratorium?*
- *How do you evaluate the <u>functionality</u> of the equipment in your laboratory?*

Schoonmaak

Dit is de dagelijkse schoonmaak van de laboratoria. Hierbij wordt rekening gehouden met de bijzondere eisen die gelden bij het betreden van laboratoria, zoals de aanwezigheid van laboratoriumpersoneel tijdens de schoonmaak. Voor sommige labs is vaccinatie van (schoonmaak)personeel vereist.

- *Hoe beoordeelt u de <u>reinheid</u> van uw laboratorium?*
- *How do you evaluate the <u>cleanness</u> of your laboratory?*

Schoonmaken laboratorium glaswerk (spoellokaal)

Het schoonmaken van het laboratorium glaswerk omvat het verzamelen, reinigen en drogen (m.b.v. speciale stoof) en het weer terugbrengen (naar hetzelfde laboratorium) van gebruikt, verontreinigd glaswerk.

- *Hoe beoordeelt u de <u>beschikbaarheid</u> van schoon glaswerk in uw laboratorium?*
- *How do you evaluate the <u>availability</u> of clean glassware in your laboratory?*

- *Hoe beoordeelt u de <u>reinheid</u> van het glaswerk in uw laboratorium, mits niet door uzelf gereinigd?*
- *How do you evaluate the <u>cleanness</u> of the glassware in your laboratory?*

Beheer laboratoriumbenodigdheden

Het beheren van het laboratoriumbenodigdheden bestaat uit het bestellen, ontvangen, opslaan, op voorraad houden en distribueren van laboratoriumbenodigdheden (zoals bepaald door het organisatieonderdeel).

- *Hoe beoordeelt u de <u>tijdige beschikbaarheid</u> van verschillende laboratoriumbenodigdheden in uw laboratorium?*
- *How do you evaluate the <u>timely availability</u> of various laboratory supplies in your laboratory?*

Beheer van chemicaliën

Het beheer van chemicaliën bestaat uit het ontvangen, controleren, registeren, en indien nodig het tijdelijk opslaan en uitgeven van chemicaliën.

- *Hoe beoordeelt u de <u>tijdige beschikbaarheid</u> van verschillende chemicaliën voor uw laboratorium?*
- *How do you evaluate the <u>timely availability</u> of various chemicals for your laboratory?*

- *Hoe beoordeelt u de <u>correctheid</u> van de registratie van de verschillende chemicaliën?*
- *How do you evaluate the <u>accuracy</u> of the registration of the various chemicals?*

Beheer van laboratoriumgassen

Het beheer van laboratoriumgassen bestaat uit de ontvangst, opslag en distributie van laboratorium gassen, zoals zuurstof, argon, helium, kooldioxide, stikstof en vloeibare stikstof. Bewaken van de vul-graad van de aan het gasnet gekoppelde gascilinders en tijdig bestellen en vervangen ervan. Bulkgassen zoals stikstof en Argon worden door de leverancier via telemetrie bewaakt en op basis van die waarneming geleverd.

- *Hoe beoordeelt u de <u>tijdige beschikbaarheid</u> van verschillende technische gassen voor uw laboratorium?*
- *How do you evaluate the <u>timely availability</u> of various gasses for your laboratory?*

Chemisch afval

Deze dienst bestaat uit het inzamelen, rubriceren, opslaan en het periodiek aanbieden van chemische afval (verschillende afvalstromen) aan de externe afvalverwerkers. Hierbij wordt voldaan aan de relevante richtlijnen en procedures.

- *Hoe beoordeelt u de <u>adequaatheid</u> waarmee chemisch afval wordt afgevoerd uit de laboratoria?*
- *How do you evaluate the <u>adequacy</u> of the removal of chemical waste out of the laboratories?*

Algemene vragen/General questions
- *Hoe beoordeelt u de <u>snelheid</u> van optreden bij eventuele storingen in uw laboratorium?*
- *How do you evaluate the <u>swift intervention</u> in the event of disruptions in your laboratory?*

- *Hoe beoordeelt u de <u>veiligheid</u> van de laboratorium werkomgeving?*
- *How do you evaluate the <u>safety</u> of the laboratory work environment?*

- *Hoe beoordeelt u de facilitaire dienstverlening in het algemeen?*
- *How do you evaluate the facilities services overall?*

- *Hoe beoordeelt u de bijdrage van de facilitaire dienstverlening aan uw werkzaamheden in het laboratorium?*
- *How do you evaluate the contribution of the facilities services to your work in the laboratory?*

APPENDIX V – QUESTIONNAIRE

The purpose of this questionnaire is to identify the desired support services, which can be offered by a facilities management department, from the user perspective. The questionnaire starts with some demographic questions. Subsequently there are questions asked about support services for laboratories. At the end of the questionnaire there is one final open question.

Completing the questionnaire takes less than 5 minutes of your time.

Demographic questions		
What is your age?		…
What is your gender?	O	Male
	O	Female
On average, how many hours per week do you use a laboratory?	O	Less than 5 hours
	O	5 to 15 hours
	O	15 to 25 hours
	O	25 to 35 hours
	O	More than 35 hours
Which description suits you best?	O	Student
	O	PhD candidate
	O	Lecturer/Professor
	O	Researcher
	O	Analyst
	O	Other, namely …

This part of the questionnaire deals with support services for laboratories. A total of 22 questions is asked spread over two pages. The answers to the questions about the support services can be given on a 7-point scale, which is structured as follows:

1 = Very poor

2 = Poor

3 = Fair

4 = Almost moderate

5 = Moderate

6 = Good

7 = Very good

If a question does not apply to your work situation, because for example you do not need this support service for your work in the laboratory, please mark N/A (not applicable).

	Very poor	Poor	Fair	Almost moderate	Moderate	Good	Very good	N/A
Specific questions support services								
How do you evaluate…								
1. …the traceability of the samples required for your work?								
2. …the availability of information concerning your samples in the registration system, such as time of entry and the actions that have been performed with the sample?								
3. …the accuracy of all the needed information of the samples in the registration system?								
4. …the storage of samples according to the required conditions?								
5. …the preparation of the samples in the correct way, if carried out by someone else?								
6. …the permanency of the temperature conditions of equipment (such as refrigerators and freezers) in your laboratory?								
7. …the authorized access to your laboratory?								
8. …the indoor climate in the laboratory in relation to your work activities?								
9. …the maintenance conditions of the laboratory you work in (i.e. ceiling, floors, walls, interior)?								
10. …the functionality of the equipment in your laboratory?								
11. …the cleanliness of your laboratory?								
12. …the availability of clean glassware in your laboratory?								
13. …the cleanliness of the glassware in your laboratory?								
14. …the timely availability of various laboratory supplies in your laboratory?								
15. …the timely availability of various chemicals for your laboratory?								
16. …the accuracy of the registration of the various chemicals?								
17. …the timely availability of various gasses for your laboratory?								
18. …the adequacy of the removal of chemical waste out of the laboratories?								
19. …the swift intervention in the event of disruptions in your laboratory?								
20. …the safety of the laboratory work environment?								
General questions support services								
21. …the facilities services overall?								
22. …the contribution of the facilities services to your work in the laboratory?								

Final question:

Are there support services, which are important for your work in the laboratory, which are not included in this questionnaire? If so, what support services?

APPENDIX VI – INTERVIEW MANUAL (DUTCH)

Introductie:
- *Introduceer jezelf*
  Op dit moment ben ik bezig met mijn afstudeeronderzoek aan Wageningen Universiteit, waar ik de MSc opleiding Facility management volg als specialisatie binnen Bedrijfskunde. Mijn afstudeeronderzoek doe ik voor het Facilitair Bedrijf van Wageningen UR (WUR).
- *Introduceer het onderzoeksonderwerp en het doel van het interview;*
  Voor mijn afstudeeronderzoek bekijk ik hoe de verschillende laboratoriumomgevingen die WUR kent facilitair gezien het beste kan worden ondersteund. Het onderzoek richt zich op de kwaliteit van de facilitaire diensten vanuit gebruikersperspectief en de onderliggende managementmotivatie voor de gekozen uitvoeringswijze. Om een goed beeld te krijgen van de best mogelijke facilitaire ondersteuning van de laboratoria van WUR heb ik gekozen voor een benchmark als onderzoekontwerp. Hierbij is het doel om inzicht te verkrijgen in de *best practices* op het gebied van facilitaire laboratoriumondersteuning. Het doel van het interview is bepalen hoe de dienstverlening op dit moment georganiseerd wordt in uw laboratoria en wat de motivatie was om dit zo te doen (bijv. risico's, kennis, kunde of financiële overwegingen).
- *Leg uit waarom de geïnterviewde gevraagd is mee te werken aan dit onderzoek;*
  Er is binnen dit onderzoek voor gekozen zowel FM als de laboratoria te betrekken tijdens de dataverzameling. Voor dit onderzoek is het belangrijk dat zowel FM als de laboratoria te betrekken tijdens de dataverzameling om een zo compleet mogelijk beeld te krijgen van de mogelijkheden voor het facilitair ondersteunen van laboratoria. Daarom is er besloten interviews te houden met facility managers en laboratorium managers op het tactische organisatieniveau.
- *Geef aan wat de belangrijkste onderwerpen zijn die tijdens het interview besproken zullen worden;*
  Tijdens het interview worden 14 ondersteunende diensten voor laboratoria besproken. De interviewvragen zullen gericht zijn op hoe de ondersteunende diensten voor laboratoria momenteel geregeld worden, wat de voor- en nadelen hiervan zijn en of er risico's verbonden zijn aan deze ondersteunende diensten.
- *Vraag toestemming om het interview op te nemen.*
- *Bespreek hoe er om wordt gegaan met de anonimiteit en vertrouwelijkheid van het interview;*
  Het interview zal in zijn geheel worden uitgetypt (transcriptievorm) en worden toegevoegd aan de bijlage van het onderzoeksrapport. Hierin zal ook uw naam en functie worden opgenomen. Gaat u hiermee akkoord of heeft u liever dat uw naam en functie niet in het onderzoeksrapport genoemd worden?

Achtergrond vraag:
Wat kunt u mij vertellen over uw functie hier in deze organisatie?

Algemene vragen:
- Hoe vindt momenteel de afstemming van facilitaire ondersteuning plaatst tussen FM en de laboratoria?
  - o Doorvragen hoe er op dit moment gecommuniceerd wordt tussen FM en de laboratoria.
  - o Doorvragen of er op dit moment gebruik wordt gemaakt van documenten e.d.
- Als er zaken (structureel) niet goed lopen als het gaat over de facilitaire ondersteuning, hoe worden deze dan opgelost?

Vragen over de ondersteunende diensten voor laboratoria:

De rest van dit interview zal bestaan uit 14 ondersteunende diensten voor laboratoria. Deze ondersteunende diensten worden eerst kort uitgelegd, waarna er een aantal vragen gesteld worden over de desbetreffende dienst. Aan het einde van het interview is er ruimte om eventuele ontbrekende diensten te bespreken.

Vragen voor elke dienst (inclusief slotvraag):
- Welk organisatieonderdeel regelt op dit moment deze ondersteunende dienst voor de laboratoria in uw gebouw(en) (FM, de laboratoria zelf, mogelijk een externe partij of een combinatie van deze partijen)?
- Wat was de motivatie voor deze keuze?
    - Doorvragen of er gekeken is naar risico's, kennis en/of kunde, kwaliteit, financiële en/of praktische overwegingen.
    - Doorvragen of dit gebaseerd is op aannames of dat er kritisch gekeken is naar bijvoorbeeld kosten, kwaliteit, etc.
- Wie moet volgens u deze ondersteunende dienst regelen en waarom?

Slotvraag:

Zijn er ondersteunende diensten, die belangrijk zijn voor de werkzaamheden in uw laboratoria, die niet zijn opgenomen in deze vragenlijst? Zo ja, welke ondersteunende diensten zijn dat?

Hartelijk dank voor uw medewerking aan dit onderzoek!

APPENDIX VII – RESULTS INTERVIEW ANALYSIS

1. Sample reception & administration

	FM	Lab	FM/Lab	Outs.	N/A	D/N
Organisation X	-	-	2	-	1	-
Organisation Y	-	3	2	-	-	-
Organisation Z	-	2		-	-	-
Wageningen UR	2	3	8		-	-
Total	**2**	**8**	**12**	**0**	**1**	**0**

This support service is currently organised by...?

	FM	Lab	FM/Lab	Outs.	N/A	D/N
Organisation X	-	1	1	-	1	-
Organisation Y	-	3	2	-	-	-
Organisation Z	-	2	-	-	-	-
Wageningen UR	-	7	4	-	2	-
Total	**0**	**13**	**7**	**0**	**3**	**0**

Who should organise this support service?

2. Sample storage

	FM	Lab	FM/Lab	Outs.	N/A	D/N
Organisation X	-	3	-	-	-	-
Organisation Y	-	5	-	-	-	-
Organisation Z	-	2	-	-	-	-
Wageningen UR	-	13	-	-	-	-
Total	**0**	**23**	**0**	**0**	**0**	**0**

This support service is currently organised by...?

	FM	Lab	FM/Lab	Outs.	N/A	D/N
Organisation X	1	2	-	-	-	-
Organisation Y	1	3	1	-	-	-
Organisation Z	1	1	-	-	-	-
Wageningen UR	-	13	-	-	-	-
Total	**3**	**19**	**1**	**0**	**0**	**0**

Who should organise this support service?

3. Sample preparation

	FM	Lab	FM/Lab	Outs.	N/A	D/N
Organisation X	-	2	1	-	-	-
Organisation Y	-	5	-	-	-	-
Organisation Z	-	2	-	-	-	-
Wageningen UR	-	13	-	-	-	-
Total	0	22	1	0	0	0

This support service is currently organised by...?

	FM	Lab	FM/Lab	Outs.	N/A	D/N
Organisation X	-	2	1	-	-	-
Organisation Y	-	5	-	-	-	-
Organisation Z	-	2	-	-	-	-
Wageningen UR	-	13	-	-	-	-
Total	0	22	1	0	0	0

Who should organise this support service?

4. Track & trace

	FM	Lab	FM/Lab	Outs.	N/A	D/N
Organisation X	-	2	-	-	1	-
Organisation Y	-	3	-	-	2	-
Organisation Z	-	2	-	-	-	-
Wageningen UR	-	11	-	-	2	-
Total	0	18	0	0	5	0

This support service is currently organised by...?

	FM	Lab	FM/Lab	Outs.	N/A	D/N
Organisation X	1	1	-	-	1	-
Organisation Y	-	3	-	-	2	-
Organisation Z	-	2	-	-	-	-
Wageningen UR	-	11	-	-	2	-
Total	1	17	0	0	5	0

Who should organise this support service?

5. Temperature registration

	FM	Lab	FM/Lab	Outs.	N/A	D/N
Organisation X	-	-	-	2	-	1
Organisation Y	3	1	-	1	-	-
Organisation Z	-	2	-	-	-	-
Wageningen UR	8	3	-	1	-	1
Total	11	6	0	4	0	2

This support service is currently organised by...?

	FM	Lab	FM/Lab	Outs.	N/A	D/N
Organisation X	1	-	-	1	-	1
Organisation Y	3	2	-	-	-	-
Organisation Z	2	-	-	-	-	-
Wageningen UR	9	3	-	-	-	1
Total	**15**	**5**	**0**	**1**	**0**	**2**

Who should organise this support service?

6. Laboratory specific access control

	FM	Lab	FM/Lab	Outs.	N/A	D/N
Organisation X	1	-	2	-	-	-
Organisation Y	2	-	3	-	-	-
Organisation Z	-	2	-	-	-	-
Wageningen UR	3	1	9	-	-	-
Total	**6**	**3**	**14**	**0**	**0**	**0**

This support service is currently organised by...?

	FM	Lab	FM/Lab	Outs.	N/A	D/N
Organisation X	1	-	2	-	-	-
Organisation Y	2	-	3	-	-	-
Organisation Z	2	-	-	-	-	-
Wageningen UR	4	-	9	-	-	-
Total	**9**	**0**	**14**	**0**	**0**	**0**

Who should organise this support service?

7. Building related maintenance

	FM	Lab	FM/Lab	Outs.	N/A	D/N
Organisation X	1	-	-	2	-	-
Organisation Y	5	-	-	-	-	-
Organisation Z	-	2	-	-	-	-
Wageningen UR	12	-	-	-	-	1
Total	**18**	**2**	**0**	**2**	**0**	**1**

This support service is currently organised by...?

	FM	Lab	FM/Lab	Outs.	N/A	D/N
Organisation X	3	-	-	-	-	-
Organisation Y	5	-	-	-	-	-
Organisation Z	2	-	-	-	-	-
Wageningen UR	12	-	-	-	-	1
Total	**22**	**0**	**0**	**0**	**0**	**1**

Who should organise this support service?

8. Laboratory-process-related maintenance

	FM	Lab	FM/Lab	Outs.	N/A	D/N
Organisation X	-	1	2	-	-	-
Organisation Y	-	2	3	-	-	-
Organisation Z	-	2	-	-	-	-
Wageningen UR	-	12	1	-	-	-
Total	**0**	**17**	**6**	**0**	**0**	**0**

This support service is currently organised by...?

	FM	Lab	FM/Lab	Outs.	N/A	D/N
Organisation X	-	1	2	-	-	-
Organisation Y	1	-	3	-	-	1
Organisation Z	-	-	2	-	-	-
Wageningen UR	2	9	2	-	-	-
Total	**3**	**10**	**9**	**0**	**0**	**1**

Who should organise this support service?

9. Cleaning

	FM	Lab	FM/Lab	Outs.	N/A	D/N
Organisation X	-	-	-	3	-	-
Organisation Y	5	-	-	-	-	-
Organisation Z	-	-	-	2	-	-
Wageningen UR	1	-	-	12	-	-
Total	**6**	**0**	**0**	**17**	**0**	**0**

This support service is currently organised by...?

	FM	Lab	FM/Lab	Outs.	N/A	D/N
Organisation X	2	-	-	1	-	-
Organisation Y	5	-	-	-	-	-
Organisation Z	2	-	-	-	-	-
Wageningen UR	4	2	-	7	-	-
Total	**13**	**2**	**0**	**8**	**0**	**0**

Who should organise this support service?

10. Laboratory glassware cleaning

	FM	Lab	FM/Lab	Outs.	N/A	D/N
Organisation X	1	-	-	2	-	-
Organisation Y	-	5	-	-	-	-
Organisation Z	-	2	-	-	-	-
Wageningen UR	2	5	3	3	-	-
Total	**3**	**12**	**3**	**5**	**0**	**0**

This support service is currently organised by...?

	FM	Lab	FM/Lab	Outs.	N/A	D/N
Organisation X	3	-	-	-	-	-
Organisation Y	2	3	-	-	-	-
Organisation Z	1	1	-	-	-	-
Wageningen UR	9	2	-	-	-	2
Total	**15**	**6**	**0**	**0**	**0**	**2**

Who should organise this support service?

11. Managing laboratory supplies

	FM	Lab	FM/Lab	Outs.	N/A	D/N
Organisation X	2	-	1	-	-	-
Organisation Y	-	5	-	-	-	-
Organisation Z	-	2	-	-	-	-
Wageningen UR	1	5	7	-	-	-
Total	**3**	**12**	**8**	**0**	**0**	**0**

This support service is currently organised by...?

	FM	Lab	FM/Lab	Outs.	N/A	D/N
Organisation X	2	-	1	-	-	-
Organisation Y	1	3	1	-	-	-
Organisation Z	2	-	-	-	-	-
Wageningen UR	3	3	6	-	-	1
Total	**8**	**6**	**8**	**0**	**0**	**1**

Who should organise this support service?

12. Managing chemicals

	FM	Lab	FM/Lab	Outs.	N/A	D/N
Organisation X	2	-	1	-	-	-
Organisation Y	-	5	-	-	-	-
Organisation Z	-	2	-	-	-	-
Wageningen UR	1	2	10	-	-	-
Total	**3**	**9**	**11**	**0**	**0**	**0**

This support service is currently organised by...?

	FM	Lab	FM/Lab	Outs.	N/A	D/N
Organisation X	2	-	1	-	-	-
Organisation Y	1	4	-	-	-	-
Organisation Z	2	-	-	-	-	-
Wageningen UR	3	3	7	-	-	-
Total	**8**	**7**	**8**	**0**	**0**	**0**

Who should organise this support service?

13. Managing laboratory gasses

	FM	Lab	FM/Lab	Outs.	N/A	D/N
Organisation X	2	-	-	1	-	-
Organisation Y	3	-	2	-	-	-
Organisation Z	-	2	-	-	-	-
Wageningen UR	8	1	3	1	-	-
Total	13	3	5	2	0	0

This support service is currently organised by…?

	FM	Lab	FM/Lab	Outs.	N/A	D/N
Organisation X	2	-	-	1	-	-
Organisation Y	4	1	-	-	-	-
Organisation Z	1	1	-	-	-	-
Wageningen UR	8	2	3	-	-	-
Total	15	4	3	1	0	0

Who should organise this support service?

14. Chemical waste

	FM	Lab	FM/Lab	Outs.	N/A	D/N
Organisation X	-	-	-	3	-	-
Organisation Y	-	5	-	-	-	-
Organisation Z	-	2	-	-	-	-
Wageningen UR	10	1	1	1	-	-
Total	10	8	1	4	0	0

This support service is currently organised by…?

	FM	Lab	FM/Lab	Outs.	N/A	D/N
Organisation X	2	-	-	1	-	-
Organisation Y	2	1	2	-	-	-
Organisation Z	1	1	-	-	-	-
Wageningen UR	11	-	2	-	-	-
Total	16	2	4	1	0	0

Who should organise this support service?