Process standardization in the construction industry

An explorative study into the right balance between standardization and flexibility

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Vasiliki-Nefeli Peponi

TU Delft Delft University of Technology
bam

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Thesis Committee

Prof. Dr. H. (Hans) Bakker (Chairman)	Delft University of Technology
Dr. Ir. LHMJ (Louis) Lousberg	Delft University of Technology
PhD student Yan Liu	Delft University of Technology
Ir. F.J. (Fokke) Huisman	Royal BAM Group

Student

Vasiliki-Nefeli Peponi
Student ID: 4744365
Construction Management & Engineering
Faculty of Engineering & Geosciences

The journey of a thousand miles begins with a single step.
(Lao Tzu, 601-531 B.C.)

Preface

Motivation, inspiration, persistence as well as all the opposites of these words have accompanied me during the past 8 months that I have been conducting my master thesis. The result is the graduation thesis lying in front of you, a partial fulfillment of the master Construction Management & Engineering at the Delft University of Technology.

I had the opportunity to conduct my research in collaboration with Royal BAM Group NL. It was a great experience and of course I owe a lot to the people that accompanied me to this journey. First of all, I would like thank my mentor, Fokke Huisman who was always by my side providing me with constructive feedback, constant brainstorm sessions that helped me through my research, as well as the courage to keep going when I was feeling lost. Moreover, my research would not have been possible without the contribution of the 32 workshop participants as well as the 9 interviewees, that provided me with their time, experience and knowledge on the topic of standardization. Last but not least, I would like to thank the UPA team for letting me be a part of their vision and work towards standardization, as well as for embracing me like an equal member.

I would also like to express my gratitude to my thesis committee from the university of TU Delft: Hans Bakker, Louis Lousberg and Yan Liu. Their guidance throughout these months was more than I could have expected. They were always close by for fruitful advice, constructive feedback and brainstorming. Furthermore, their direct, open and helpful attitude contributed to a good and honest collaboration.

Finally, I would like to thank my close friends, , family members and fellow CME graduate students. You provided support when needed, even when you did not realize it, just by being a joyful distraction or by listening to my concerns.

Enjoy reading!

Vasiliki-Nefeli Peponi
Delft, August 2019

Executive Summary

INTRODUCTION

Project complexity in the construction industry in combination with the dynamic character of the economic markets have led to the need of continuous process management improvement. Large multinational companies that go global, trying to keep up with the everyday competitiveness are always seeking ways to improve their performance by exploiting previous gained knowledge and avoid common pitfalls. Process standardization is a way to improve current practices. An organization has a lot to gain by process standardization, whether the right balance between standardization and flexibility is reached.

Although research around the topic of process standardization does exist, when the scope is narrowed down to the construction industry the findings are scarce. Furthermore, despite all the spoken benefits of process standardization in an organization's performance the question why it has not been fully implemented in the construction industry has not been answered. Finally, there is not a clear answer on how to achieve the right balance between process standardization and flexibility.

This research aims at identifying which are the factors that determine whether a process should be standardized or not within and across a large, multinational construction company. In a bigger scale, the right balance between process standardization and flexibility is investigated. The research approach is founded on the following research question:

"Which are the determining factors for the decision behind standardizing a process within and across all operating companies of a large multinational construction company?"

To answer this question, the following sub-questions were formulated:

1 What does process standardization mean and why has it not been fully implemented yet in the construction industry?
   1.1 What is the impact of process standardization on a business?
   1.2 What are the drivers of business process standardization?
   1.3 What are the challenges and barriers of the implementation of standardization in the construction industry?
2 Which are the different perspectives around the factors that determine whether a process is suitable for standardization or not?

Answering and combining the sub-questions will contribute to achieving the objective of this research that is formulated as follows: "to explore the potential of developing a uniform process workflow to be used within a large, multinational, construction company by all its Operating Companies".

THEORETICAL FRAMEWORK

The theoretical framework is answering the first sub-question and prepares the context of the research analysis. First, a definition of business process standardization is provided. After that, the impact of process standardization on business performance is examined, as well as the factors that influence the degree of process standardization. In particular, process standardization is found to be benefiting process performance, quality, time reduction, control, outsourcing success and readiness, global integration, compliance with regulations, customer confidence, collaboration, consensus, technical interchangeability, learning effect and economies of scale. It is also found to have a two-way effect on process cost, process flexibility and creativity.

Factors that influence the degree of process standardization are: managerial factors, process related factors, firm related factors, IT related factors and external factors. The required data for the research derived from process related factors, firm related factors and external factors. More precisely, the factors used for the research are:

- Level of routine & structuredness
- Input, output, sequential variety
- Process-type (primary/support)
- Process documentation
- Personal differences
- Process complexity
- Degree of interdependence
- Different locations
- Resources constraints
- Product/Services variety
- BPM capability
- Legal requirements
- Environmental risks

Last but not least, the challenges and barriers of implementing standardization in the construction industry are explored. Barriers are linked to the characteristics of the construction industry. More precisely, it is found that the fragmented nature of the construction industry, the procurement method and contract restrictions, financial issues, lack of top management commitment and support, design and construction dichotomy, the conservative industry, the lack of large-scale and repetition possibilities and the strong focus on lowest bid price are challenging standardization in the construction industry.

THE RESEARCH

To answer the second sub-question, Q-methodology is used to retrieve different perspectives of the employees of a large, multinational, construction company on the subject of process standardization. More precisely, perspectives are gathered on the factors that are more/less

important for process standardization. 4 perspectives could be extracted, showing the different preferences amongst these four groups.

In the end, similarities and differences of the extracted perspectives are gathered and examined. As a result, a factor model that suggests which factors define a process suitable for standardization from a process that should or should not be standardized, as well as moderators of process standardization is drawn. The research is conducted in the context of the company Royal BAM Group.

CONCLUSIONS - RECOMMENDATIONS

Recommendations are provided based on the comparison of the derived model with the literature findings on business process standardization and the extracted perspectives. Moreover, recommendations are made regarding the implementation of the model on a way to surpass the standardization challenges in the construction industry as researched in the literature review.

The research identifies 8 factors that indicate a process that should be standardized: significance (Core Values, Profit Impact, Quality Assuracne Checking, Cost), risk, risk reduction related, complexity, Operating Company's topic relevance, business unit Interdependent, number of participants, routine & interdependent, routine & simple and acquired innovation. 2 factors are indicating a process that should not be standardized: external risk and required innovation in process. 6 factors are found to be working as either moderators of process standardization or indicating a process suitable for process standardization.

Royal BAM Group is provided the following advice:

- Do not only focus on technology; , it is always people that will ultimately determine whether a new system will work well (Lorenzi & Riley, 2000). The 4 different perspectives identified indicate different preferences of these groups. Focus on a common goal, explore the similarities between the different groups' preferences as well as the reason behind the differences, make proper use of relational governance, create communication, coordination and consensus between the different groups of the company.
- Gain top management support and commitment. However, top managers should not only focus on their goals and preferences.
- The suggestion of a new model should be done from internal top managers of each Operating Company or Business Unit.
- Invest in organizational learning and hence create an appropriate organizational culture that will be more willing to accept change.
- Aspects related to the human factor – clients, markets and knowledge should not be disregarded.
- Invest in appropriate change management, as suggested by Kotter (Kotter et al., 2012)
- Take into account the 4 identified perspectives and accomplish a smoother approach of these teams.

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List of Abbreviations

BPS: Business Process Standardization

BPM: Business Process Management

BU: Business Unit

NA: Not Affecting

OpCo: Operating Company

PLC: Project Life Cycle

SWOT: Strengths, Weaknesses, Opportunities, and Threats

UPA: Uniform Project Approach

PART I

INTRODUCTION

1. Problem Introduction

The first chapter is the starting point of this research. Subject is introduced in section 1.1. In the sequence, the problem statement is formulated in section 1.2. Before starting with the actual research, it is required to have a defined research scope. Section 1.3 discusses the context of the research; business processes and project lifecycle. The company context is elaborated in section 1.4.

1.1 Subject Introduction

Today's rising project complexity in combination with the changing economic environment has led to an increased interest in improving organizational business processes (Trkman, 2010). Large multinational companies were always affected by those two factors in a greater extent than other smaller more localized competitors, rendering process reengineering an indispensable need for their continuous thrive. Determining best-practice approaches and integrating scale and knowledge into business process management may improve business performance by reducing error potential. (Trkman, 2010). This could be achieved through process standardization according to best-practice approaches.

Process standardization aims at creating a uniform process workflow and hence a sense of "common language". Various benefits of business process standardization have been documented through time. More precisely, it is claimed to provide lower costs of execution, improved collaboration between business units or between the organization and its business partners, reduced time of a process, reduced cost overruns and increased quality (Beimborn, Gleisner, Joachim, & Hackethal, 2009; Davenport, 2005; Hammer & Stanton, 1999; Jayaram, Vickery, & Droge, 2000).

However, the proclaimed uniqueness of construction projects in combination with the numerous uncertainties that the industry is facing (Polesie, 2009) is rendering process standardization in the construction industry more complex. This research aims to explore the implications, opportunities and barriers of standardization in the construction industry and the implementation of previously gained knowledge – marked as best practices. In that way, the uniqueness of a project is going to be respected and at the same time, scalable learning is going to be exploited in order to stop "re-inventing the wheel".

1.2 Problem Statement

According to many studies, process standardization – when wisely applied - can prove very beneficial to the performance of a business, as it improves operational performance, reduces costs, facilitates communication and profits from expert knowledge (de Toni, 1993; Jayaram, S.K. , 1998; Manrodt, 2004; Phelps, 2006; Wuellenweber, 2008). Process standardization has become a necessity for global operating companies, taking into consideration the exchange of information and activities that take place among companies and business units (Liu et.al., 2009). Münstermann (2010) summarized the advantages of process standardization in five categories: improved process performance, enhanced readiness and ability to react to regulatory changes, enhanced technical interchangeability and improved customer confidence. Last but not least, since information systems support processes, standardization allows uniform information

systems within companies (Davenport, 2005), availing the performance and the scalable learning within large companies that consist of many operating business units.

However, many authors state that standardization and routines optimize effectiveness under normal operating conditions (Roberts, 1990; Vogus & Welbourne, 2003), but when faced with unanticipated circumstances, teams and organizations are most effective when they can innovate and improvise (Gilson, 2005) in order to respond efficiently in new, unknown markets (Gibs and Heywood, 2012). Gibs and Heywood (2012) also questioned the effectiveness of a standardized business process when it comes to people from different cultures. Another opposing view is that "many processes are more art than science" (Trkman, 2010). Imposing strict rules on them stifles innovation, reduces accountability and harms performance, which is why according to many authors over-standardizing processes like that should be avoided (Benner and Tushman, 2003; Hall and Johnson, 2009). According to Münstermann (2010), process standardization hinders creativity and innovative activities and therefore process standardization and innovation/creativity are mutually exclusive. However, as Kondo (2000) states, "innovation and work standardization are […] not mutually exclusive but mutually complementary". Appendix A summarizes the supporting and opposing views on process standardization.

Striking the right balance between process standardization and flexibility remains a challenge for the construction industry. The underlying problem is that the critical factors that determine the desired degree of process standardization are not known. More research is needed in order for the construction industry to be able to prosper from the benefits of business process standardization.

1.3 Context

This research is referring to business processes of construction companies through a project's lifecycle. As business process is defined a complete, dynamically coordinated set of activities or logically related tasks that must be performed to deliver value to customers or to fulfill other strategic goals (Guha, 1993; Strnadl, 2006). All levels of business processes are going to be researched in order to derive at the desired degree of process standardization. However, it is not in the scope of this research to name the processes that are suitable for standardization, but define the features that a process like that should have.

In terms of project lifecycle in a construction project, we determine the following stages: business development and tendering, project kick-off, preparation of construction works, management of construction activities, closing of project - handover of deliveries and asset management and service activities.

1.4 Company context

The case company for this research is Royal BAM Group. Royal BAM Group is one of the largest international construction firms in Europe, consisting of 20.000 employees and ten operating companies in five European home countries, as well as projects in niche markets worldwide. During the past years, the company is focusing on how to boost its performance and enhance profitability and capital efficiency. Solid and direct transformations are vital in order to reach this goal.

With the “ONE BAM” program, Royal BAM Group aims at constant improvement within and across the organization by exploiting scale and knowledge. Throughout its ten operating companies there is tremendous amount of expertise and knowledge, in terms of local markets and clients, but also in terms of the construction industry and profession as a whole. In order to become a well-connected collaborative business in which everyone can learn from each other, share problems, innovate and avoid reinventing the wheel, business processes and tools need to be aligned in and among business units and operating companies. In that, the right balance between the standard and the unique needs to be researched. Having to compete within the global market, Royal BAM Group is investigating what could be done more “globally” instead of “locally”.

The main initiatives through ONE BAM project are open collaboration, scalable learning and predictable performance, which are going to be supported by a Uniform Project Approach program. It is expected that by doing so, project teams are going to be benefited by lower administrative burden, easier way of working and knowledge share and clients will be experiencing improved predictable performance, time and budget delivery as well as more clarity on progress. Moreover, regarding its shareholders and society, Royal BAM Group will be perceived as a solid and consistent brand with better market perception and improved predictability of forecasts.

Currently, ONE BAM has sorted out 61 Best Practices in their high impact processes through a project’s lifetime that have been already applied in completed projects. The question however remains unsolved; till what extent of process level should standardization be implemented? What are the criteria that determine the right balance between standardization and flexibility of processes?

2 Research Approach

The second chapter focuses on the research approach of the thesis. Section 2.1 describes the research goal. The main research question and the sub-questions that will fulfill the aforementioned goal are formulated in section 2.2. Section 2.3 discusses the research objective. Any scientific and societal relevance is discussed in section 2.4. Finally, the methodology approach is explained in section 2.5, complemented by a research framework provided in section 2.6.

2.1 Research Goal

This research is dedicated to close the knowledge gap described in section 1.2. More precisely, the goal of this research is to develop a uniform model for decision making. This model will be presenting the critical factors that determine which processes would be beneficial to be standardized and to what extent, based on operating companies' (OpCos) best practices. All OpCos of a large multinational construction company should then "comply or explain" to the standardized processes. By that, a degree of freedom is attributed to each operating company to decide whether it is most beneficial to comply with the uniform process approach or deviate from it, after having efficiently explained the reasons to do so. It is a challenge to preserve flexibility to the desired level, so as to not stifle innovation and agility to market and external change. Last but not least, it should be noted that cultural, technical and contractual differences that exist within and among the various OpCos will be taken into consideration in this research.

2.2 Research Question and Sub-questions

Due to the dynamic character of process management of a business unit it can be concluded that processes in construction companies need continuous improvement. A uniform project approach that would be followed by operating business units of a large company had always been appealing. However, the key success factors of this approach are not investigated yet. From this point of view, it can be concluded that a new approach towards process optimization and standardization is desirable to achieve the outmost of a company's scalable learning. The main question is thus formulated as:

"Which are the determining factors for the decision behind standardizing a process within and across all operating companies of a large multinational construction company?"

To make sure a clear answer can be presented to the research question at the end of the research, sub-questions have been formulated. With each sub-question different aspects of the research are elaborated on.

The first sub question addresses why process standardization has a potential application in the construction industry and in parallel, among multinational cooperate business units of a company. Moreover, the standardization initiatives that are taken at BAM will be discussed.

1 What does process standardization mean and why has it not been fully implemented yet in the construction industry?
   1.1 What is the impact of process standardization on a business?
   1.2 What are the drivers of business process standardization?
   1.3 What are the challenges and barriers of the implementation of standardization in the construction industry?

The second sub question gathers the different perspectives on the factors that determine if a process is suitable for standardization or not. In order to do so, a literature review on the drivers, moderators and mediators of business process standardization is conducted (sub-question 1.2).

2 Which are the different perspectives around the factors that determine whether a process is suitable for standardization or not?

A model of factors that determine if a process should be standardized, is suitable for standardization, is moderating the procedure of process standardization or should not be standardized at all is then proposed, providing an answer to the main question.

2.3 Research Objective

Answering and combining the sub-questions will contribute to achieving the objective of this research that is formulated as follows: "to explore the potential of developing a uniform process workflow to be used within a large, multinational, construction company by all its OpCos". From this objective, the five deliverables included in this thesis have been derived. These are:

1. A recommendation on which factors determine process standardization in a construction company.
2. The flexibility degree that needs to be attributed to that process standardization.
3. An advice on what is the required balance between standardization and flexibility that needs to be respected in the uniform project approach, focusing on Royal BAM Group.
4. A recommendation regarding the implications of the model in Royal BAM Group.
5. A recommendation based on the comparison between business process standardization and standardization results that stem from Royal BAM Group.

2.4 Scientific and Societal Relevance

Although process standardization is considered one of the broad future research directions (Venkatesh, 2006), there are still some grey zones in its academic and practitioner literature. Many studies have been conducted on the potential benefits of standardization in the construction industry. However, empirical exploration on process standardization is scarce. In addition to that, there are no studies so far indicating the critical criteria that define the desired level of process standardization in the construction industry. Investigating the equilibrium between standardization and flexibility had always been a challenge both on academic and practitioner level. This research is dedicated to close the existing knowledge gap and define the right balance between standardization and flexibility in processes by pointing out the critical

factors that determine the optimum degree of standardization or flexibility. On a higher level, this research aims at improving standardization initiatives in Royal BAM Group and resolving the ambiguity around that issue.

From a societal relevance, there is a strong need for a productive and innovative construction sector because of its monetary value and importance for the development of a sustainable society (Eriksson Per Erik, 2014). Moreover, as we live in an era of market globalization, it is vital for global companies to be competitive by excelling at scalable learning and inter-cooperation.

2.5 Research Methodology

The starting point of this research is a literature review that explores the drivers and consequences of business process standardization (BPS). In order to do so, the definition of business process standardization is firstly provided. In a second step, the characteristics of the construction industry are described in order to later on investigate the challenges of implementing standardization initiatives in construction. The findings are also enhanced with statements from interviews conducted with company experts. Thereinafter, the impact of BPS on an organization's performance is investigated. Finally, the drivers of BPS as well as potential mediating and moderating factors are retrieved from literature and gathered in a framework that illustrates BPS drivers and impact.

The second part of this research methodology is focused on the human factor. In particular, the different perspectives of BAM's employees on the topic of process standardization and its drivers are investigated. In order to provide valid recommendations for the company as well as make a cross validation with the literature framework, this step was deemed more than necessary. The most suitable method to accomplish that is Q-methodology. Q-methodology is a method that provides qualitative and quantitative methods to investigate the subjective views of the people involved in a particular topic (Herrington & Coogan, 2011). After applying this methodology and extracting different perspectives of the employees towards the determining factors of BPS, a model that consists of critical factors for process standardization for Royal BAM Group is proposed. The model stems from the consensus of the participating employees of the company towards process standardization factors. In the end, recommendations are provided that stem from the comparison with literature findings as well as from the validation of the model.

2.6 Research Framework

The outline of this research consists of 10 steps that are connected to the three main parts of this research; the theoretical framework, the research and the recommendations. These steps will lead to fulfilling the objective of the research as described in section 2.3. The 10 steps are:

1. Literature study on business process standardization, construction industry characteristics and challenges on the implementation of standardization initiatives.
2. Literature study on the impact of BPS on an organization's performance and its drivers, moderators and mediators.
3. A conceptual theoretical framework that illustrates drivers of BPS, impact on business and mediating and moderating factors of BPS.

4. Interviews are held with BAM experts on the topic of process standardization.
5. The required data to perform Q-methodology are gathered and presented.
6. Q-methodology analysis is ran and perspectives of BAM experts on the determining factors of BPS are gathered.
7. Results are interpreted.
8. A model that consists of determining process standardization factors for the company is proposed.
9. The model is validated through interviews with company experts.
10. Recommendations are provided.

Figure 1 provides a graphical representation of the research framework.

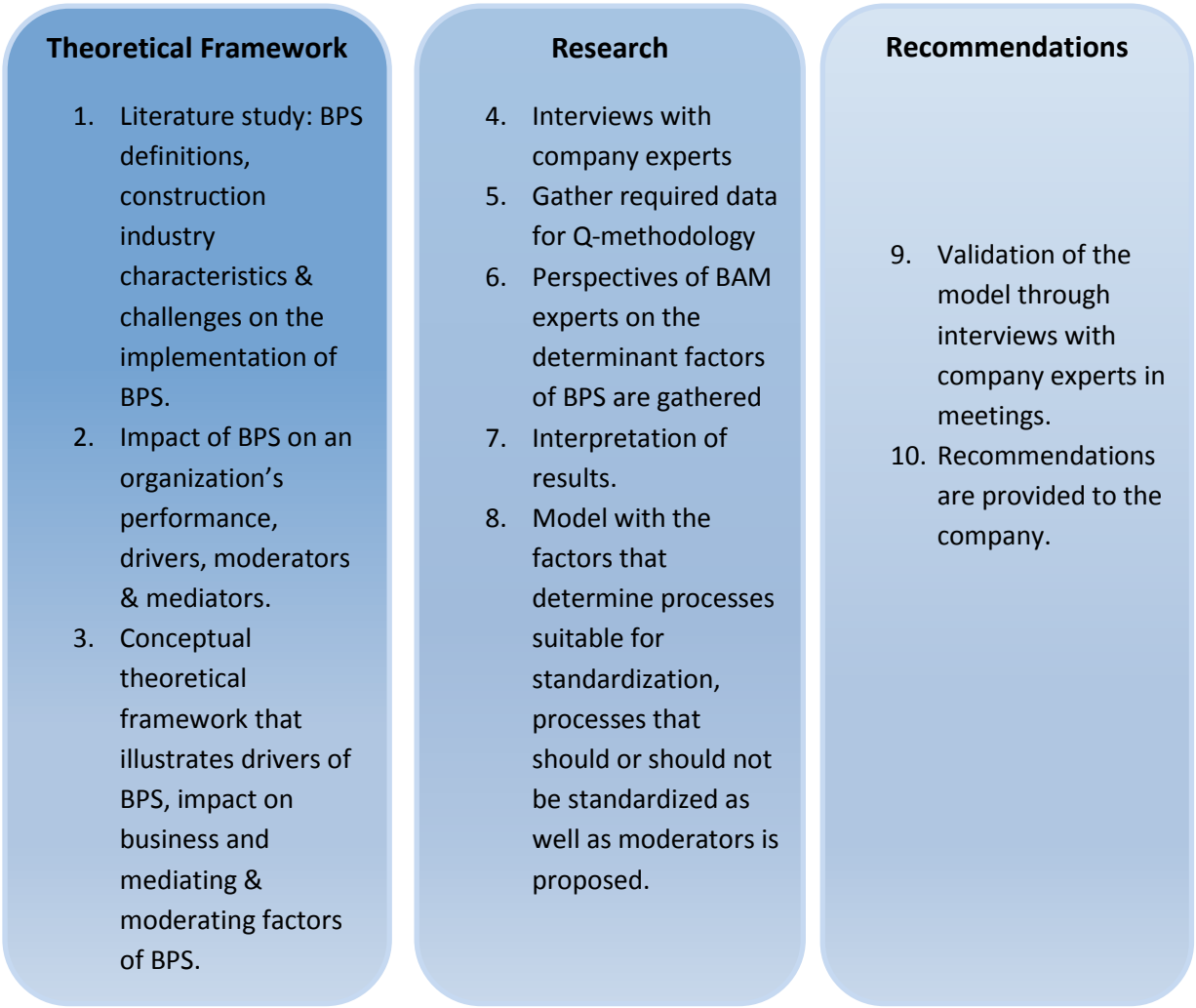


Figure 1. Research Framework

PART II

THEORETICAL FRAMEWORK

3 Process standardization and the construction industry

This chapter elaborates on process standardization and its application in the construction industry. On a first step, the definition of process standardization is provided in section 3.1. Section 3.2 then investigates the impact of process standardization on a business. A framework illustrating the contextual factors that influence business process standardization and their impact on an organization's performance is drawn in section 3.4. Section 3.6 elaborates on the barriers and challenges of the application of process standardization in the construction industry and makes the link between the characteristics of the construction 's industry nature that are elaborated on section 3.5. Finally, the current state of Royal BAM Group regarding process standardization is described in section 3.7.

3.1 Business process standardization

According to O'Connor, O'Brien, and Choi (2015), standardization can be defined as "the extensive use of components, methods or processes in which there is regularity, repetition and background of successful practice and predictability". Standardization can be distinguished in two main strategies: product standardization and process standardization. This research will only investigate process standardization and its application in the construction industry.

Starting with the definition of a business process as the object of investigation, a common definition by Davenport and Short (1990), defining the business process as "a set of logically related tasks performed to achieve a defined business outcome". Münstermann (2014) has gathered a vast number of publications that provide definitions of business process standardization (BPS) as well as perspectives on it. Table 1 summarizes a selected number of them.

Table 1: Business process standardization definitions

Reference	Definition and Perspectives on BPS
Bandow et al. (2008)	"Process standards describe how activities or a sequence of activities should be conducted. They represent the "best way" known as problem solution at a specific point in time for a selected process. Such a process standard is implemented as-to-be process and "frozen" until a better process is developed, i.e. new knowledge that can be used for further optimization becomes available. [translated from German]"
Wüllenweber et al. (2008)	"The objective of [process] standardization is to make process activities transparent and achieve uniformity of process activities across the value chain."
Beimborn et al. (2009)	"Process standardization ultimately defines a reference standard to which different versions of the business process, e.g. running

	in different business units, within the firm need to conform."
Beimborn et al. (2009)	"Process standardization allows the identification and implementation of best practices throughout the firm. If the firm merges several variants of the same process, it can identify the variant showing the highest performance and apply this as the new "process standard"."
Münstermann and Eckhardt (2009)	"Business process standards are aligned process variants that incorporate external best practice knowledge, e.g. by adopting (parts of) an external reference process and are verifiably considered to be the time, cost and quality optimal way of achieving the business goal."
Beimborn et al. (2011)	"Standardization and consolidation is the goal-directed homogenization (i.e. reduction of process variants) and realization of economies of scale for process bundling and shared service centers."
Dai et al. (2011)	"Business processes can be standardized in a firm so the same function is performed the same way across different units and locations. Process standards can be based on external standards or defined by the firm."
Schaefermeyer et al. (2010)	"Thus, we specify business process standardization as the unification of business processes and the underlying actions within a company in order to facilitate communications about how the business operates, to enable handoffs across process boundaries in terms of information, to improve collaboration and develop comparative measures of process performance."

Judging from the definitions provided in Table 1, business process standardization provides a reduction in process variants according to previously gained knowledge, marked as "best practice knowledge" in order to reach to higher business performance. Why then is business process standardization not widely implemented in the construction industry since it is best practice? In order to provide an answer, the BPS impact on the performance of a business, its drivers as well the reasons behind implementation barriers need to be investigated.

3.2 Impact of process standardization on business performance

In this section the impact of business process standardization on organizational performance is investigated. The aspects that are found are: cost, performance & efficiency, time, transparency, measurability, outsourcing success & readiness, communication & collaboration, quality, responsiveness, enhanced readiness & flexibility, creativity, customer confidence, technical interchangeability, increased learning effect and global integration. These aspects are elaborated below.

- Cost: Process standardization leads to reduced costs according to 16 research publications. Cost reduction is linked to an improved operational performance and hence to a decrease in process errors (Schäfermeyer et al., 2012; Wüllenweber et al., 2008). However, most publications insist that cost reduction is not the main and only benefit from process standardization. "Cost savings are attributed to higher efficiency, decreasing risks, improved transparency, controllability and quality." (Schäfermeyer et al., 2012). The really high need for investment though, drives to the increase in a company's costs.
- Performance – efficiency: Ungan (2006) argues that BPS brings about consistent operations and therefore enhances efficiency. This view is supported by Rohloff (2011) who states that the objective of BPS is to increase effectiveness and efficiency of all business processes of an organization. Buchta et al. (2010) propose that IT supported BPS work as a mediator to business process efficiency and effectiveness.
  Dai, Kauffman, and Wang (2009) presented another interesting finding in their paper regarding business process standardization. In particular, they present process standardization as the mediator in the effect of market volatility and business performance (Romero, Dijkman, Grefen, & van Weele, 2015). In fact, a rise in market volatility leads to an increase in firm performance as a result of primary business performance standardization (Romero et al., 2015).
- Time: Another value dimension mentioned many times in the reviewed research publications is reduced process time. According to Davenport and Short (1990), BPS is an ideal unit for a focused time reduction analysis and examining causes of time overruns. Jayaram et al. (2000) propose that BPS improves supply chain time performance as it enables the identification of "sources of delay, unnecessary steps and opportunities for parallelism".
- Transparency: Transparency of process activities is said by many authors to be achieved by business process standardization. This can be attributed to the introduction of a common language and process documentation (Münstermann, 2014). According to Wüllenweber et al. (2008) "the objective of process standardization is to make process activities transparent and achieve uniformity of process activities across the value chain". Tregear (2010) also argues that process activities are becoming more transparent by collecting, collating and disseminating the process knowledge that exists within a business.
- Measurability: Increased measurability of performance is also mentioned by many authors. Measurability refers to the definition of metrics to measure and manage process performance (Münstermann 2014). Process standardization facilitates measurability of process performance due to common metrics, transparency and comparability across all

process variants with the same approach (Münstermann 2014). Schafermeyer (2010) positions the developments of process performance measurability as an explicit objective of business process standardization.

- Outsourcing success & readiness: Wüllenweber et al. (2008) argue that process standardization leads to the design and negotiation of more detailed and complete contracts between parties involved in a process, which is positively affecting the outsourcing success. This is an indirect effect of the increased transparency and measurability of processes. Hence, contractual governance works as a mediator to high business and technological uncertainty where contractual provisions are difficult to design (Romero et al., 2015).
  It is worth mentioning that process outsourcing within the organization is known to be increasing the number of process variants that coexist. As these variants differ in aspects of performance such as efficiency, quality and cycle time, standardizing these variants leads to a consolidation of process volumes and allows a business to exploit economies of scale (Romero et al., 2015)
- Communication & collaboration: Schafermeyer (2010) continues with acknowledging the enhanced communication around the way a business operates, the facilitation of hand-offs across process boundaries in terms of information and the improved collaboration. Wüllenweber et al. (2008) also argue that communication is mediated by relational governance. As they say: "Using process standards allow a better understanding about how the business operates and can be improved. This facilitates communication and coordination between exchange partners and allows realigning disparate goals and actions to solve day-to-day problems. These finding show that process standardization increases the effectiveness of relational governance." (Wüllenweber, 2008)
- Quality: Improved quality is also achieved by process standardization, as an effect of the decreased process errors. According to Wüllenweber et al. (2008), standardization of business processes aims at improving operational performance by a decrease in process errors. In addition to that, Schafermeyer (2010) states that with the use of standard parts and standard operating procedures for process activities, operator discretion, ambiguity and opportunities to make errors are decreased and thus higher quality levels are reached.
- Responsiveness, Enhanced Readiness & Flexibility: Process standardization provides the companies with enhanced readiness to react to regulatory changes – enhanced process flexibility - and hence, increased ability to comply with regulations (Münstermann, 2010). According to Snowdon et al. (2007) "process flexibility comprises the tasks necessary to implement new procedures in order to change organizational capabilities repeatedly, economically and in a timely way". Standardizing business processes is essential in acquiring flexibility and readiness to react to changing environmental circumstances (Davenport, 2005). However, over-standardizing would lead to loss of flexibility and competitive advantages (Aysolmaz, 2017). Therefore, the right balance between process standardization and flexibility could be translated into the combination of standardized processes with necessary variants (Aysolmaz, 2017).
- Creativity: Creativity is mentioned by Perez-Alvarez and Watad (2004) to be a value dimension of BPS. In particular, they state that "conducting standardized processes can yield

a higher level of creative outcomes, often as a consequence of employees been less procrastinated". Hence, employees have more time in their disposition to be creative wherever is needed the most. Their view however is opposing to Trkman (2010), Hall and Johnson (2009), Münstermann (2014) and Benner and Tushman (2003) who argue that BPS is impeding creativity and stifling innovation. The right balance between process standardization and degree of freedom should be struck in order to overcome a negative outcome of this aspect.

- Customer confidence: Improved customer confidence is another value mentioned by many authors as a consequence of BPS, as standardized processes have less potential to process-driven mistakes (Münstermann, 2010). By customer confidence we define the customer's satisfaction with the quality of the provided products or services that a business offers as an output of its processes (Münstermann, 2010).
- Technical interchangeability: Technical interchangeability is recognized in 3 reviewed publications as a benefit that stems from BPS. In particular, Bandow et al. (2008) argues that BPS allows joint requirements towards IT systems as well as IT projects across regions and locations. Hence, we can conclude that IT moderates the effect of BPS on technical interchangeability.
- Increased learning effect: Rohloff (2011) states the increased learning effect of BPS as it contributes to the preservation of process "know-how" and process expertise, since a common framework is used across all business units and regions.
- Global integration: Last but not least, Girod and Bellin (2011) points the enhanced potential of global integration and cross-country efficiency as a consequence of BPS. However, a company's size and the industry sector – degree of its competitiveness - work as mediators in this effect.

3.3 Factors that influence the degree of process standardization

In this section, contextual factors that are exerting an influence on business process standardization are gathered and described. Factors have been grouped in 5 sectors: managerial factors, process related factors, firm related factors, IT related factors and external factors. Mediating and moderating factors of BPS are also presented at the end of the section.

3.3.1 Managerial factors

Managerial factors refer to an organization's managers' leadership style and their approach to change management which is usually dependent on the organizational context, i.e. mergers and acquisitions or process outsourcing within the organization (Münstermann, 2010).

- Managerial practice

Mergers between companies with different products or services require change and adaptation of their supporting activities such as purchasing and marketing (Romero et al., 2015). Variety in products and services may need variation in their correlated processes (Tregear, 2010a). Moreover, they lead in additional process variants that coexist (Romero et al., 2015). By standardizing these variants, processes are unified and hence economies of scale are enabled

(Romero et al., 2015). According to Beimborn et al. (2009), "if the firm merges several variants of the same process, it can identify the variant showing the highest performance and apply it as the new process standard".

The way an organization responds and manages mergers and acquisitions is related to its managerial practices. In particular, it is the way an organization responds to change and its leadership style; both of these elements differ according to the organizational context, e.g. mergers and acquisitions or outsourcing (Münstermann, 2010).

- Top management support

Top management support plays a significant role in the successful process standardization initiative as well. As top management we define "the extent to which top managers in the organization provide direction, authority and resources for business process standardization within an organization" (Ifinedo, 2008). Aspects of top management mentioned by Münstermann (2014) are: participation in business process standardization initiative decision meetings, showing support to the initiative by committing to it in presentations and newsletters and the providing of the best and most knowledgeable resources to the initiative.

3.3.2 Process related factors

Process related factors refer to the type and nature of a process to be standardized and therefore the type and nature of its respective process variants (Münstermann, 2010). Process related factors are described by 8 contextual factors that are elaborated below.

- Level of routine & structuredness

This driver refers to the repeatability of the (sub-)activities of a process (Münstermann, 2010). The level of structuredness is defined by either the level of transactionality of the process or the level of routineness (Romero et al., 2015). A highly transactional process is one that enables a smooth single business transaction between the provider and the customer. A highly routine process is one that in most cases is handled in the same way, in contrast to for example creative processes (Romero et al., 2015). According to Lillrank (2003) and Schafermeyer et al. (2010), transactionality and routineness affect the standardization potential of a process. Rosenkranz et al. (2010) also conclude that "non-routine processes are less applicable to standardization than routine processes…", as different parts of a process need creative decision making and thus flexibility is required. In addition to that, there are also unstructured, unmeasured and unrepeated processes that can hardly be standardized (Romero et al., 2015). An example to the aforementioned is knowledge work which is said to be impossible to document and standardize (Tregear, 2010a).

The maturity level of a process has also its share in BPS. In particular, Rosenkranz et al. (2010) concluded that process maturity has a positive impact on standardization potential. In fact, they observed that organizations with at least a moderate level of process maturity respond better in standardization initiatives (Rosenkranz et al., 2010).

- Input, output, sequential variety

This aspect refers to the number of process cycles, the degree of input, output and sequential variety, data standardization, potential previous complexity reduction and personal preferences that lead to higher variety (Münstermann, 2010).

The higher the degree of uncertainty, the lower the process standardization success (Schafermeyer et al., 2010). Uncertainty increases with input variety, lack of employee' skill and procedural knowledge to carry out a process as well as environmental instability (Schafermeyer et al., 2010). Schafermeyer et al. (2010) conclude that uncertainty drives employees to search for alternatives in order to guarantee successful execution of a process and reach the desired outputs and hence, creativity and flexibility are needed.

- Process type (primary/support)

Processes are distinguished into primary and support processes. Primary business processes are summed up by value activities that directly transform inputs into final outputs whereas support processes support primary processes and have an indirect effect on the final output (Dai et al., 2011).

- Process documentation

Polanyi (1966) once said: "we know more than we can tell". Based on that, individuals involved in a process develop their way of working and experience difficulty in communicating it (Ungan, 2006). The biggest challenge regarding process documentation is to extract tacit knowledge from people and clearly depict it into written documents.

It is important that people that document knowledge are aware of the different types of knowledge. As stated by Ungan (2006), process knowledge is a know-how (procedural knowledge) or information (descriptive knowledge). Either a process is procedural or information, the more knowledge is documentable the more possible it is to be standardized.

According to Lam (2000), operational skills and know-how obtained though practical experience are hard to standardize and communicate. Bae (1993) argues that process documentation is important for a company to accomplish minimum possible variation.
It is of great importance that documentation is clear to any employee since it will be used by employees in different locations as well (Ungan, 2006)

- Internal/External source of BPS definition

This factor refers to the source of the definition of a process standard. More precisely, it refers to whether an organization uses sources that are within the boundaries of the examined organization or beyond them (Münstermann, 2010). According to Münstermann (2010), sources for BPS definition are characterized by the following factors: 1) the involvement of employee knowledge across regions and locations of the "to be examined" organization, 2) potential

already available BPS frameworks (within and across the boundaries of the examined organization), 3) external expertise and 4) selected knowledge process factors.

It is worth mentioning that when a best practice stems from an external of the subject organization source, employees usually show reluctance to change and adopt (Münstermann, 2010); a phenomenon called “not invented here” syndrome according to Leijen (2005).

- Enforceability/Urgency

This factor refers to the sense of urgency of an organization towards the standardization of its business processes. It can be also translated to an organization’s ability to deviate from a process standard (Münstermann, 2010).

- Personal differences

As Ang and Massingham (2007) stated, the level of differences in national culture plays a great role in deciding on process standardization degree. In fact, they suggest that the greater the differences, the more difficult it is to transfer knowledge across cultures.

Moreover, in inter-firm collaborations, the relationship among firms is an attribute of organizational variation that affects the scope, structure and performance of these collaborations (Romero et al., 2015). Various factors could govern inter-firm relationship, such as power-distance, partners’ financial and legal independence and operational and cultural diversity (Romero et al., 2015). According to Moffat and Archer (2004), organizations with low power distance had a higher level of business practices’ integration, whereas those with medium and high power distance had a low integration level. This could be mediated by proper knowledge management (Romero et al., 2015)

Personal differences that are introduced in a process by employees, affect the success of process standardization initiatives (Romero et al., 2015). More precisely, processes that require medium to high work experience or tacit knowledge are less likely to be successfully standardized (Schafermeyer et al., 2010). Furthermore, strong differences in personal preferences impede standardization (Tregear, 2010a).

Last but not least, personal differences exist in the way people perform the same task as well. Skills, competencies and behaviors determine people’s performance (Münstermann, 2010) and keeping into mind the fact that the same task performed by different people can lead to different outputs, personal differences in the way people perform their task exerts an impact on BPS.

- Process complexity & degree of interdependence

Wüllenweber et al. (2008) state that high complexity and high interdependencies are features of a process that hamper standardization success. If interdependencies are only a few or are of low complexity, coordination between different partners is enabled (Wüllenweber et al., 2008) and therefore, integration is facilitated.

3.3.3 Firm related factors

Firms that go global and have different working locations have to take into account to their BPS level differences in legal requirements, frequency of interaction between individuals performing different tasks, personal differences in the way of working, possible resource constraints as well as differences in products and services (Romero et al., 2015). BPM capability and BPS initiative execution excellence are also falling under the umbrella of firm related drivers.

- Organizational structure

Organizational structure influences standardization initiatives according to Girod and Bellin (2011). In particular, in their research they describe how a hierarchical network that is based on both vertical and horizontal relationships enables a smooth transition to decisions that stem from the headquarters. Moreover, they explain that standardization benefits the principle of distributed leadership – a feature of hierarchical network (Girod & Bellin, 2011). Factors such as company size and industry sector are working as mediators to this relation (Girod & Bellin, 2011).

- Corporate governance

Corporate governance is the set of rules, practices and processes by which an organization is managed. Since corporate governance deals with how to balance every company's shareholder interest and provides the framework for achieving the companies objectives, it is without a doubt an influencing factor of BPS.

- Different locations

For companies that are operating globally, different locations do not only affect the degree of standardization due to differences in regulations, but also due to the frequency of interaction between individuals performing different tasks (Romero et al., 2015). Individuals have their own way of working (personal differences) which is shaped by their cultural background (Romero et al., 2015). While standardizing process variants across an organization's functional and geographical structure seems very appealing for a number of reasons, over standardizing business processes might lead to undesirable outcomes and hinder meeting local requirements (Münstermann, 2010). Tregear (2010a) calls the decision behind the right trade-off between standardization of processes across different functional and geographical regions and preserving local process variations the "standardization dilemma".

- Resource constraints

Resources may differ from location to location. They may be scarce, not affordable or even not available at all in a different location (Münstermann, 2010).

- Product/Services variety

Due to their interconnected nature, products or services that are part of a process highly influence the success of process standardization. According to Aapaoja and Haapasalo (2014),

when aiming for the full exploitation of the benefits of process standardization, the use of standardized products is required. As they also claim, "processes should be defined in such a way (tacit work knowledge and methods) that they enable the effective use of standardized products or components and vice versa".

- BPM capability

BPM capability refers to an organization's capability to manage business processes effectively and efficiently; ongoing commitment from the organization is thus implied in order to meet its objectives and properly manage its processes (Münstermann, 2010). Münstermann et al. (2010) presents the following aspects of BPM capabilities: 1) BPM experience, BPM processes and systems, 3) investment in BPM, 4) architecture to gather best practices, 5) measurement systems for measuring impact and 6) an organization's share of process oriented working resources. BPM constitutes a driver to BPS as the ability to continuously manage, improve and check business processes exerts an impact on it.

- BPS initiative execution excellence

BPS initiative execution is another determining factor of BPS as it constitutes all the previously gained experience and excellence of an organization before it opts for a BPS initiative (Münstermann, 2010). According to Münstermann (2010) BPS consists of: 1) the scope of a potential process standardization initiative, 2) the setup of BPS, its initiative team, 3) the selected approach to retrieve the best practices of an organization, 4) the IT support of the targeted standardized process, 5) the involvement of the affected from the BPS parties and 6) the involvement of other departments such as HR and IT.

- Business IT alignment

Business IT alignment refers to the alignment of an organization's IT strategy and structures regarding its capabilities, routines, processes and resources (Beimborn et al., 2009). An organization's business processes are influenced by the type and level of IT alignment and thus business IT alignment constitutes a driver of BPS.

3.3.4 IT related factors

Centralized IT governance is affecting the level of process standardization, leading to a higher level (Romero et al., 2015). Differences in IT lead to different systems in similar functional areas, decentralized IT departments or even insufficient IT service levels that would be definitely improved by standardization (Buchta et al., 2010). IT factors are distinguished in three sections: IT capabilities and usage, software/system introduction and IT landscape variety/architecture.

- IT capabilities & usage

The factor related to IT capabilities and usage refers to an organization's capability to deploy and use IT based resources in combination with other resources and capabilities, in order to facilitate organizational activities and work processes (Münstermann, 2010). IT capabilities and usage are

divided into two levels: 1) a functional technology level that examines how IT is used in business processes and 2) an IS strategy level which can be seen as the result of strategic investments (Barua, Kriebel, & Mukhopadhyay, 1995; Björn Münstermann, 2010). As IT capabilities and usage encompass an important role on business processes, they comprise a determinant factor of BPS.

- Software/System introduction

IT and system introduction is also considered a driver of BPS as it can change an organization's business processes (Münstermann, 2010). The most common example of this driver is the introduction of an ERP system. According to authors, "the introduction of a new ERP system requires changes to the business processes to be supported" (Münstermann, 2010).

- IT landscape variety/architecture

Last but not least, IT landscape/architecture is considered the last driver that exerts an impact on BPS in the IT domain. Some aspects identified from literature along IT landscape/architecture are: 1) an organization's overall IT system variety, 2) the existence or non-existence of joint IT platforms, 3) potentially implemented service oriented architectures, 4) the corresponding degree of service granularity and 5) the degree of centrality of potentially installed SOA governance (Münstermann, 2010). As IT systems support the execution of business processes, IT variety and architecture affect the processes of a business and consequently BPS.

3.3.5 External Factors

External factors refer to the aspects that deal with an organization's ability to react to changed industry/market imperatives and cope with different legal requirements (Münstermann, 2010) . In order to do so, an organization needs to adopt its processes accordingly.

- Industry/Market imperatives

Market imperatives and trends comprise a driver that has been widely mentioned in literature. According to Münstermann (2014) "this driver refers to overall economic conditions, the degree of competitiveness of the respective industry, specific potentially changing market conditions and potential market volatility as well as potential local market imperatives and other potential pressures". In order to respond to the aforementioned, change is inevitable and therefore this factor influences the degree of process standardization.

- Legal requirements

According to Tregear (2010a), there are mandatory and unavoidable variations that stem from differences in regulations such as financial regulations, taxation regimes, import/export regulations and employment practices. Potential political requirements as well as changes in regulations to which a business has to comply with play an important role in process standardization. In order to be able to respond to these changes, a business has to change its processes accordingly and thus the level of standardization that is achieved in a company is inevitably influenced by those variations.

Romero et al. (2015) suggest that the degree of process standardization depends on the degree of similarity between machines or systems that enables interchangeability of parts and components between different process variants.

- Environmental risks

According to Moffat and Archer (2004), environmental risks refer to business and technological uncertainty. High degree of environmental risk leads to higher urgency for process standardization. However, the higher the environmental risk, the more difficult it is to standardize the relevant process (Moffat & Archer, 2004). The reasons behind this, is usually the lack of partner commitment or strategic alignment (Moffat & Archer, 2004). Moffat and Archer (2004) suggest that the main way to battle this event, is by aligning the members' strategic goal.

- Relationship characteristics

Relationship characteristics are affecting an organization's scope, structure and performance (Moffat & Archer, 2004) and therefore they have their share in BPS. As relationship characteristic, Moffat & Archer (2004) propose power inequalities, financial and legal interdependencies, a firm's skills and operational abilities as well as the operational and cultural diversity.

3.3.6 Mediating factors on BPS

- Relational governance

Lack of collaboration between project participants that is driven from the fragmented supply chain as well as culture and habits hampers process standardization (Aapaoja & Haapasalo, 2014). According to Wüllenweber et al. (2008) relational governance – and in particular communication, coordination and consensus - works as a mediator on BPS and increases the value dimensions of outsourcing success and global integration.

- Contractual governance

According to Wüllenweber et al. (2008), process standardization is a driver for the effectiveness of contractual and relational governance. Contractual governance is mediating the effect of BPS on outsourcing success. This is a result of higher transparency with enhanced documentation of processes, increased measurability of process output and control throughout the process – due to the standardization of the examined process – and hence, the designation of more detailed and complete contracts.

- Knowledge management

Knowledge management is defined by the activities around capturing, developing, sharing and using knowledge within an organization (Münstermann, 2014). It encompasses a great role in an organization's business processes as it is actually the "memory" of an organization (Münstermann, 2014). Hence, according to Münstermann (2014), the way an organization is

handling its knowledge is greatly influencing the way its processes are conducted. Knowledge management constitutes a mediator of relationship characteristics and plays a significant role both in the reduction of process time and integration (Romero et al., 2015).

- Organizational learning

Organizational learning is a complex process that deals with knowledge development and behavior change (Huber, 1991; Slater & Narver, 1995). Companies with a strong learning culture are good at creating, acquiring and transferring knowledge and insight (Huber, 1991; Škerlavaj, Štemberger, & Dimovski, 2007). Škerlavaj et al. (2007) argue that organizations should be able to learn as well as respond to challenges from both internal and external environments if they want to achieve competitive advantage. They suggest that it is very important to create an organizational environment in which employees can and should continually learn and share their knowledge. Hence, effort, time and money should be invested in order to develop a strong learning oriented culture which will lead to enhanced performance in terms of hard factors as well as relationships within and across the company (soft factors) (Škerlavaj et al., 2007). According to Škerlavaj et al. (2007) it is of high importance for managers to put the factor of people in first priority in order to accomplish process efficiency and effectiveness. Hence, the degree of organizational learning of a business works as mediator to the effect of BPS on efficiency and effectiveness.

- Process control

Beimborn et al. (2009) conclude that process control mediates the effect of BPS on efficiency bringing on positive results.

3.3.7 Moderating factors on BPS

- Organizational culture

According to Škerlavaj et al. (2007), organization culture plays a vital role when aiming to improve organizational performance by business process change. Indeed, studies argue that most problems arising around business process management are not technical but rather stem from an inappropriate organizational culture that may impede the implementation of innovations as well as achieving superior levels of performance (Hammer, 2004; Terziovski, Fitzpatrick, & O'Neill, 2003). As organizational culture we define the customary and traditional way of doing things, which is shared to an extend by all members of an organization and which new members should learn and at least partially embrace in order to be in accordance with a firm's services (Škerlavaj et al., 2007). Organizational culture has various dimensions. An organization is characterized by a combination of cultural orientations and not solely by one of them. It should be stated though that usually one of them is dominant (Škerlavaj et al., 2007). Furthermore, when aiming for change, managers should take into consideration that they are dealing with national culture and other contextual variables along with organizational culture (Hofstede, 2011).

Organizational culture is found to be moderating the impact of IT related factors on BPS (Romero et al., 2015)

- IT intensity

Beimborn et al. (2009) conclude that the effect of BPS on business performance, time and quality is moderated by IT intensity.

3.4 Conceptual framework: drivers and consequences of BPS

Figure **2** Illustrates drivers of business process standardization and its impact on organizational performance. This framework is useful for collecting the required data regarding process characteristics that determine whether a process should be standardized or not. Despite the fact that not all of these drivers are used for the research, they were intentionally elaborated in order to be able to better comprehend the research's results and draw as much accurate recommendations as possible.

The required data for the research is derived from process related factors, firm related factors and external factors. More precisely, the factors used for the research are:

- Level of routine & structuredness
- Input, output, sequential variety
- Process-type (primary/support)
- Process documentation
- Personal differences
- Process complexity
- Degree of interdependence
- Different locations
- Resources constraints
- Product/Services variety
- BPM capability
- Legal requirements
- Environmental risks

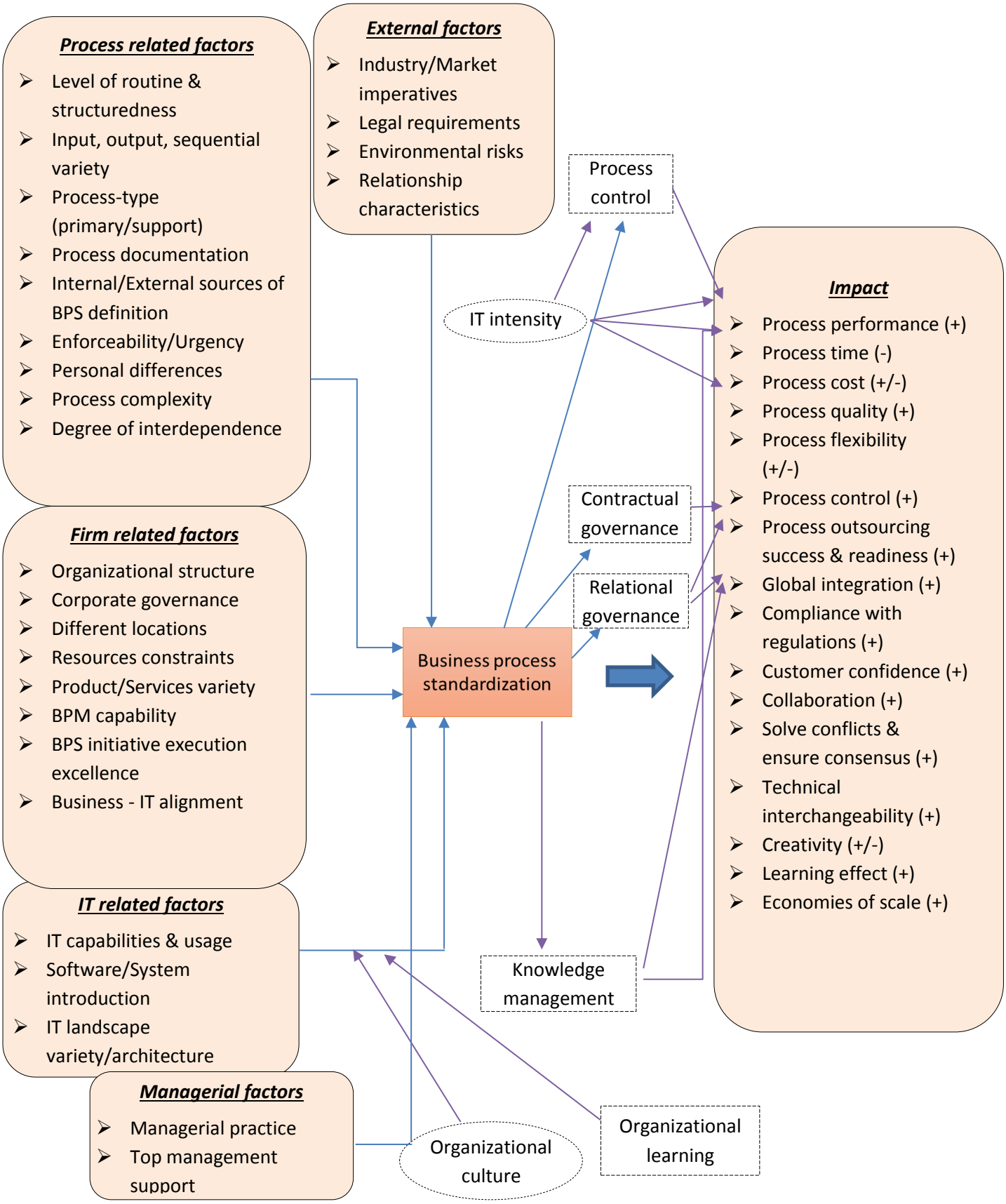


Figure 2: Drivers and impact of BPS on organizational performance

3.5 Characteristics of the construction industry

In order to successfully link benefits and drawbacks of process standardization in construction companies, the characteristics of the construction industry are explored.

Construction projects are mainly characterized by a fragmented structure, one-of-a-kind production, site production and working in temporary teams (Vrijhoef & Koskela, 2005). According to Larsson, Eriksson, Olofsson, and Simonsson (2015) these features partly explain inefficiency that construction projects face.

In construction, relations are built around project works, rendering the construction industry fragmented by its nature. Cooperation of different firms and disciplines is temporary and project specific. Communication is usually limited between the different parties as each party is mainly focused on its own part (Ancella Stout, 2016). Fragmentation is one of the causes behind the failure of projects as well as of implementing a standard (Stouffs & Krishnamurti, 2001). Apart from relations, the industry is experiencing fragmentation in information storage and exchange as well (Larsson et al., 2015).

The construction industry has to deal with one-of-a-kind projects. Every project is considered unique, taking into consideration the different locations, designs, objectives, scope and stakeholders of a construction project. In contrast to the routine based industries, processes in the construction industry are mainly project based (Ancella Stout, 2016).

According to Vrijhoef and Koskela (2005) construction can be described as the design and installation of specific objects on site. When production is done on site, risk factors – e.g. weather conditions, soil conditions – arise.

The temporary nature of a construction project's team is an antecedent of the fragmented structure of the industry as well as its project based nature. As a consequence, employees are used to work in temporary teams for a certain period of time and do not see the point in building a relationship with each other (Stout, 2016)

3.6 Challenges & barriers of implementing standardization in the construction industry

There are various barriers identified in the implementation of standardization in the construction industry, most of which are connected to the nature of the construction industry (see section 3.5). These barriers are summarized below, according to Sarhan and Fox (2013).

- Fragmentation and subcontracting.
- Procurement method and contract restrictions.
- Financial issues.
- Culture and human attitudinal issues with resistance to change.
- Lack of adequate awareness and education around standardization.
- Lack of top management commitment and support.
- Design and construction dichotomy.

- Lack of customer focused and process based performance measurement systems.

Larsson, Eriksson, Olofsson, and Simonsson (2014) provide 5 different challenges in standardizing in the construction industry. In particular, they state the following challenging aspects:

- Conservative industry culture.
- Lack of large-scale and repetition possibilities.
- Design-bid-build contracts.
- Impaired aesthetics and quality.
- Strong focus on lowest bid price.

The conservative culture of the construction industry leads to the belief that every construction project should be considered as unique, overlooking in that way some forms of repetition found in every project. Hence, the opportunity to learn from past experience and stop re-inventing the wheel is missed. This is attributed to the conservative nature of the construction industry and the unwillingness to change.

The lack of large-scale and repetition possibilities in combination with the design-bid-build contracts make it more challenging for a contractor to apply standard processes if the isolated parties from the design part do not agree with that.

Impaired aesthetics and quality work constitute a challenge towards standardization. When using standardized products and processes, the aesthetics and quality of those standards are not optional, which is in contrast to the above aspect.

Last but not least, the strong focus on the lowest bid price is a challenge for standardization as the latter requires high investment on the short term. Therefore, the focus on the lowest bid implies that there is possibly no room for these kind of investments.

3.7 Process standardization initiative at Royal BAM Group – Current state

Over the years Royal BAM Group has come through several standardization initiatives on different organizational levels. This chapter is focusing on the current state and the Uniform Project Approach program. Since early 2019, the company has started the initiation of UPA which was the result of the Executive Committee's decision on new strategy and values. Large bleeders on projects resulted in bad performance and undesired effects. As a consequence, UPA was initiated. Experts were then hired by BAM to start the UPA program so as to identify how to overcome similar situations and exploit scalable knowledge. In order to reach this objective, experts first conducted a set of interviews with selected people from 10 successful and 10 problematic projects. From the interviews, root causes of bleeders as well as good practices during a project's lifecycle (PLC) were identified which lead to the formulation of 65 best practice principles for successful project management. Experts then asked from every OpCo to deliver their own "best practices" on these subjects as input. Thereafter they selected and/or developed the best practices and scoped them down to "BAM Practices" – i.e. processes. The next step is

to train every OpCo on the identified practices and in a final step, implement them. These practices will constitute minimum requirements for every OpCo's specific procedures.

3.7.1 Project bleeders & root causes

For the investigation of project bleeders, the three PLC stages were investigated:

1. business development and tendering
2. design and pre-construction
3. construction, close out and asset management

At a first stage, more than 300 issues were defined from all teams. After a rationalization of those initial issues, they were decreased to 9 most common issues with 3 issues per phase.

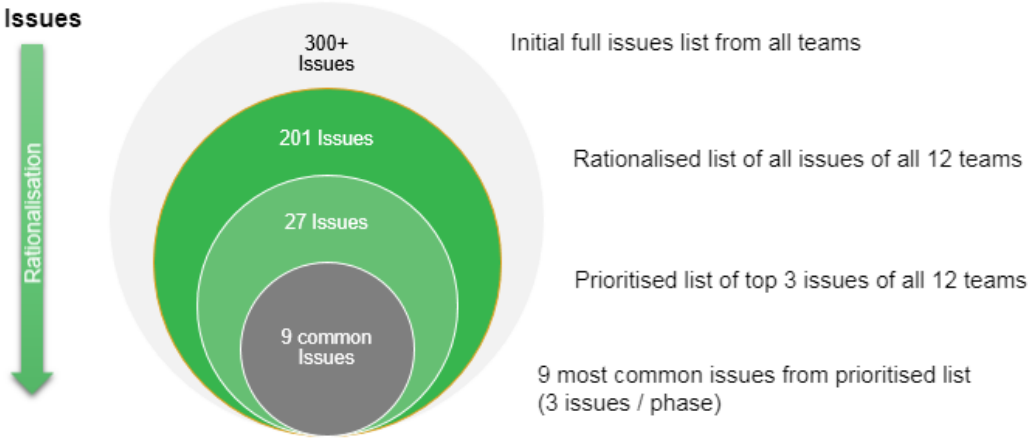


Figure 3. Rationalization of issues described from all teams.

The 9 identified top issues along with their root causes are illustrated in Figure 4.

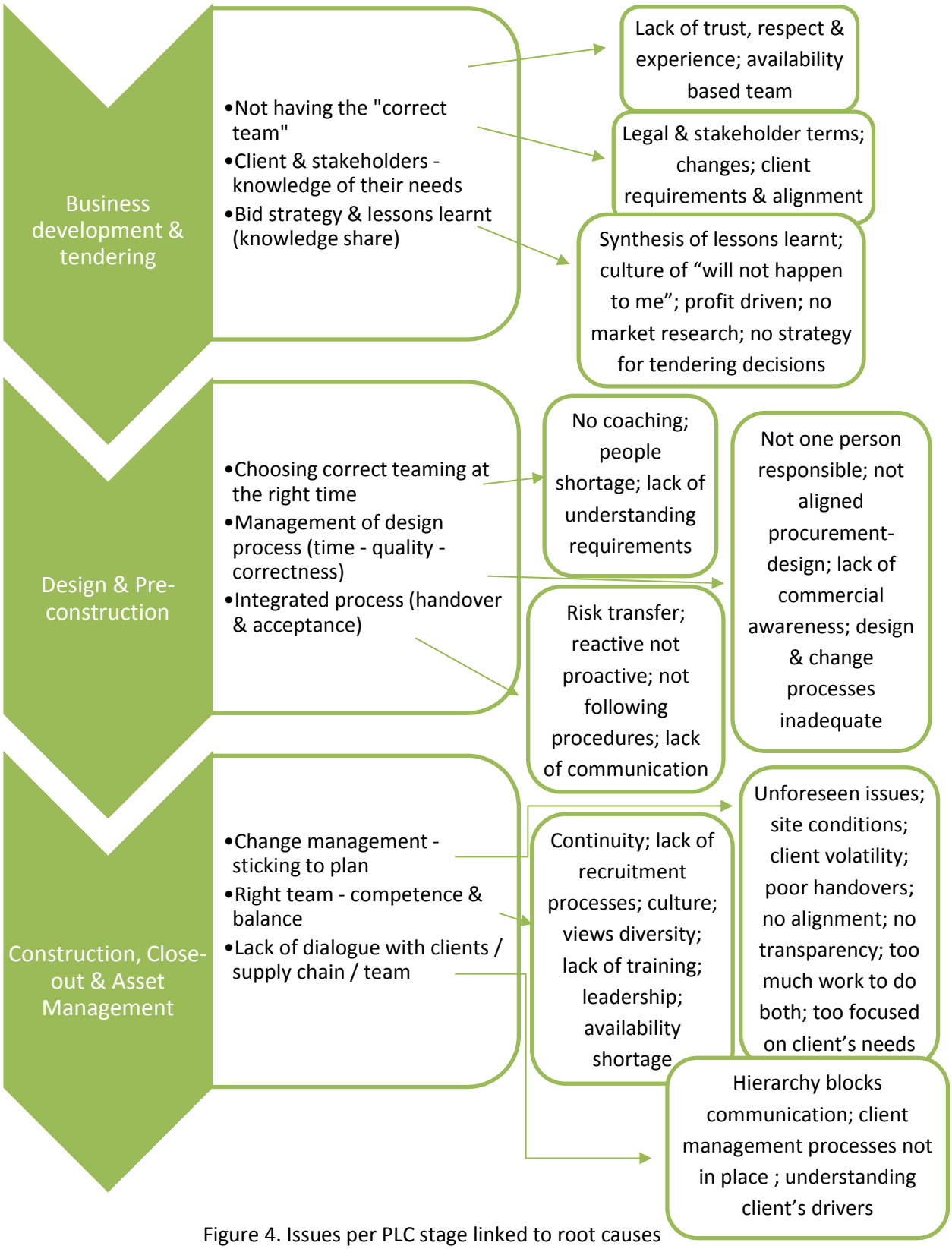


Figure 4. Issues per PLC stage linked to root causes

As can be seen from Figure 4, some of the root causes can be linked to the features of the construction industry as described in 3.6. In particular, fragmentation and subcontracting can be seen in the lack of alignment, lack of continuity, poor handovers and “many hands” responsibility. The strong focus on the lowest bid price (financial issues) can also be seen in the profit focus.

Although the experts concluded to a number of “good practices”, they did not propose the factors that drive a process to be standardized. BPS drivers are the stepping stone between the identification of these practices and their implementation.

PART III

THE RESEARCH

4 Research method description: Q-methodology

This chapter provides an overview of the Q-methodology. First, a short introduction of Q-methodology and the reasons behind its selection for the execution of this research are elaborated in section 4.1. Then, a description of the method and an explanation of its steps are provided in section 4.2. Finally, the relevance of Q-methodology with the set research goal as well as the main limitations of this method are described in section 4.3.

4.1 Introduction

Q-methodology or Q-study was invented by William Stephenson in the 1930s and can be used in any research field to study subjectivity (Stephenson, 1953). According to McKeown and Thomas (2013) subjectivity can be described as a person's communication of a point of view on any matter of personal or social importance. With Q-methodology different opinions and attitudes of individuals can be summarized and expressed in collective perspectives (Brown, 1993). In this research, Q-methodology is used to identify the participants' perspective regarding the factors that influence process standardization within and across the company's business units. This methodology allows the participants to give a view that reflects their subjectivity. No other methods capture the essence of what participants feel about a topic from collective voices, while at the same time identifying subtle differences between some of these voices (Watts & Stenner, 2012).

For this research, it is acknowledged that as BAM's employees are directly affected by the initiative to find a Uniform Project Approach to which all OpCos should "comply or explain" and hence their perspective on that should be highly taken into consideration. As Q-methodology shows the individual perspectives on the topic to be examined, it acknowledges the fact that organizations are built up by individuals (Kraus, 2018). By examining BAM's employees' perspectives on the criteria that determine process standardization, trust is established as it is shown that their opinion does matter and is taken into account. After all, as Lorenzi and Riley (2000) stated, no matter how good the technology, it is always people who will ultimately determine whether a new system will work well.

Q-methodology offers an innovative approach to qualitative analysis through a "quantification of patterned subjectivities" (Shemmings, 2006). As Brown (1980) states, it is a good combination between quantitative and qualitative research. The good combination of quantitative and qualitative lies within the power of Q-methodology to measure the relative perspective of the respondents on the statements, the quantitative part, and subsequently to reveal the motives for the subjective ranking by the respondents by interviewing them while they are sorting the statements, the qualitative part (Watts & Stenner, 2012). In this research method, persons become the variables of interest (Watts & Stenner, 2012) and thus, its goal is to find a correlation between the participants and not between any other type of variables.

4.2 Method description

For the execution of Q methodology, four steps are going to be followed (McKeown & Thomas, 2013):

1. Sampling of the concourse (Q sample)
2. Selection of research participants (P-set)

3. Ranking of statements (Q-sort)
4. Analysis of data

4.2.1 Sampling of the Concourse

According to Brown (1993), the concourse refers to the flow of communicability surrounding any topic and is a collection of all possible information about the topic of interest. Information can be gathered from primary sources (interviews, group discussions) or secondary sources (literature, newspapers) (Du Plessis, 2005). In this research, both ways of collecting information are used. In particular, information is gathered through literature review and semi-structured interviews. Information from literature was gathered from reviewed research publications on the drivers of BPS as well as criteria and factors that exert an influence on standardization initiatives.

For the completion of the concourse, interviews have been held with selected employees of Royal BAM Group. Interviewees have been selected with the criterion that they hold knowledge on the topic of process standardization and they share different views. Furthermore, some of them should be part of the Uniform Project Approach team so as they can provide more accurate information about the topic under research. According to Brown (1993) one should intend to obtain as much diversity as possible on variables such as gender or age. Hence, diversity is obtained by interviewing employees with different background, job positions, who work in different departments and come from a different operating company. Interviews are audio-tape-recorded and transcribed verbatim (Watts & Stenner, 2012). Appendix D shows the interview questions used.

From the concourse statements are been drawn, which is called the Q-set (Van Exel & De Graaf, 2005). The Q set consists of a number of statements which is the set of the criteria influencing process standardization within and across BAM's business units. The extraction of statements from literature review and interviews is elaborated on section 4.4.2. In brief, statements are firstly highlighted from literature and the interviews. Then, these statements are subdivided into various categories of interest (Watts & Stenner, 2012) in order to facilitate the final step, the duplication check. Statements are assessed for duplication; only one out of duplicated statements is kept in the end (Watts & Stenner, 2012).

4.2.2 Selection of research participants

The second step in Q-methodology is the selection of the P-set (McKeown & Thomas, 2013) or the person-sample (Du Plessis, 2005). The criterion behind the selection of the P-set is that diversity is obtained and different viewpoints are been gathered. Therefore, participants are employees of Royal BAM Group from different OpCos, various backgrounds and working experience, experience with process standardization, knowledge of BAM's initiative on creating a Uniform Project Approach as well as different working departments. Those were the criteria that were deemed the most important ones in order to achieve different viewpoints on the topic of research.

4.2.3 Ranking of statements

Once all statements (Q-set) are generated, they are placed on cards in order for the participants to sort them in their preferred order of preference (Van Exel & De Graaf, 2005). The statements are sorted by placing them on a Q-grid in a scale ranging from mostly agree to mostly disagree.

41 statements are generated in total. Due to the time constraints of this research, Q-sort is conducted during 3 different workshops held at BAM Group. In these workshops, employees from different business units of BAM are been gathered. The participants are asked to rank the statements by answering to the question "What is your opinion regarding the factors that influence process standardization? Please, rank the following statements from mostly agree to mostly disagree."

4.2.4 Analysis of data

At this step, each completed Q-sort is correlated with the other participants' Q-sorts and factor-analyzed (Herrington & Coogan, 2011). A factor represents a portion of shared or common meaning that has been or that could potentially be extracted from the sum of the Q-sorts (Watts & Stenner, 2012). Factor analysis will reveal similarities between participants' Q-sorting; participants with similar Q-sorts will significantly load on the same factor, providing in that way a pattern of their subjective views (Herrington & Coogan, 2011).

According to Watts and Stenner (2012) "the basic function of a factor analysis is to account for as much of this study variance as possible". Every researcher should decide on the number of extracted factors according to what he wants to achieve. Q-factors and the meaning they enclose will lead to the extraction of the common viewpoints within the P-set and hence, the different perspectives regarding the determining criteria on process standardization. Perspective extraction is thus the last step of data analysis and is directly linked to the degree of similarity of each Q-sort provided by the P-set.

Software PQMethod version 2.35 is used for the data analysis. The selection of this software was based on the fact that it is freely accessible and is widely suggested by previous researchers on Q-methodology (Herrington & Coogan, 2011; Kraus, 2018; van Tiel, 2018; Watts & Stenner, 2012). PQMethod 2.35 will generate one Q-sort for each factor that will be representative of the common ranking of the statements from the participants that loaded on that factor (Herrington & Coogan, 2011).

4.3 Limitations of Q-methodology

A main limitation attributed to Q-method is the fact that Q-sorting is an extremely time consuming process (McKeown & Thomas, 2013). Usually participants are new to Q-methodology and thus, sufficient explanation about both the method itself and the way it is executed should be provided before the Q-sorting. Validity is therefore affected if participants did not fully comprehend the method, leading to the misrepresentation (McKeown & Thomas, 2013).As stated by McKeown and Thomas (2013), the use of focus groups that allow several participants to arrange their Q-sort at the same time would be time saving. Taking the above into consideration, the Q-sorting is done during 3 workshops in which participants are first given a short introduction to the method and instructions on how to do the Q-sort before actually heading to the process of statement ranking. Furthermore, participants have the ability to clarify right away any ambiguities on what they are requested to do but an intended degree of ambiguity is attributed to the statements in order to leave them space to defold their own views on them.

Moreover, Q-methodology uses a small sample rendering the generalization of any findings quite difficult (Thomas & Baas, 1992). However, as Brown (1980) says, the idea behind Q-methodology is that there is only a limited set of perspectives behind a specific topic. Thus, as long as the factors are extracted, the number of participants that load on a factor does not hold

any significance. Furthermore, according to Thomas and Baas (1992) the generalization of the Q-findings is of less relevance in Q-methodology; it is the identification of the various perspectives that does matter and not the definition of which part of the population adheres to each perspective. For this research, it is relevant what the participants think as they are directly affected by BAM's process standardization initiative in which they will have to "comply or explain".

4.4 Q-Methodology Set Up

This chapter presents the final Q-set . First of all, statements from literature review and interviews are generated. Statements are checked for duplication. In the final set of statements only one out of two similar statements is been kept. Finally, statements that have derived from the 2 different sources – literature and interviews – are also checked for duplication in order to reach to the final set of statements.

The q-sort procedure is then described. The q-sort is been done during 3 workshops that consisted of BAM employees from different countries. Before that, a "test" workshop is conducted were the procedure and the statements are examined on their functionality.

Finally, the q-analysis is done with PQMethod 2.35. Four factors are extracted and translated afterwards into perspectives.

4.4.1 Set up the literature study

The first step of sampling the concourse is through a literature review. After a thorough literature study, statements about factors, criteria or process characteristics that determine whether a process is suitable for standardization or not are extracted. Statements are then checked for duplication. Literature research conducted in section 3.3 is also used for collecting statements.

A literature research in scientific and academic publications is conducted, using Google Scholar, Scopus and TU Delft's online library as a database. Furthermore, TU Delft's repository is used to retrieve old master thesis that are a good fit to this research. Keywords such as "process standardization criteria", "process standardization factors", "determination of processes for standardization", "successful factors process standardization" in combination with "construction industry" and "business units" are used. Literature was selected with the criterion that:

1. It provides up to date information
2. It provides the latest trends
3. It is suitable for the construction industry

Literature research findings were introduced in section 3.3, where the factors that influence business process standardization are elaborated. The research could not be scoped down solely to the construction industry. Instead, statements refer to business process standardization. The scope will be narrowed down after the extraction of perspectives.

As mentioned in section 3.4 , not all proposed factors are used for the research analysis. As the research is narrowed to process characteristics, the factors used are: level of routine & structuredness, input- output & sequential variety, process-type (primary/support), process documentation, personal differences, process complexity, degree of interdependence, different

locations, resources constraints, product/services variety, BPM capability, legal requirements, environmental risks.

4.4.2 Statements from literature – determining factors on BPS

Statements have been grouped into 8 categories; degree of frequency, strategic significance of business process, degree of process variety, degree of predictability, degree of complexity, degree of tacit knowledge, degree of interdependence and market and client statements. The categorization of statements was chosen as a way to facilitate the duplication checking. The categories are explained in Table 2.

Table 2: Categories of Statements

Degree of frequency
As degree of frequency of a process we define the rate of occurrence process (Duan 2007).
Strategic significance of business process
Strategic significance means the ability of a process to fulfil the company's strategy in order to realize competitive advantages (Croom and Brandon-Jones 2005). In the case of Royal BAM Group, strategic significance concerns profitability, safety, people, core values and environment.
Degree of process variety
Variety represents different ways to fulfill the same need (Lillrank 2003). We define as inefficient process variety as the amount of the different, inefficient ways to perform a process.
Degree of predictability:
The degree of predictability represents the possibility to observe a process in that way that the necessary actions of the process can be determined ex ante (Lillrank and Liukko 2004).
Degree of complexity
Process complexity is a function of the number and variety of all activities forming the business process, their interrelation and dynamics (Schafermeyer, Grgecic et al. 2010).
Degree of tacit knowledge
According to Krogh et.al. (2000), tacit knowledge is that kind of knowledge which can hardly be articulated (Krogh, Ichijo & Nonaka 2000: 6).
Degree of interdependence
The aspect of interdependence enables the comprehension of how the different processes within a company depend on the performance of others.
Market and Clients
There is a distinction between localized and global processes. Localization refers to the process of making a product or a process more accessible to different audiences. In a globalized market from the other hand, processes are standardized in order to fit the needs of multiple customer bases.

Appendix C illustrates the retrieved statements and their source of retrieval. The duplication check was done after retrieving statements from interviews and questionnaires as well.

4.4.3 Statements from interviews - determining factors on BPS

Semi-structured interviews are held in order to retrieve possible statements that were missing from literature and can be provided by company experts. Moreover, BAM employees might be experiencing process standardization in a different way and hence their feedback was deemed indispensable.

The aim behind the interviews is to obtain up to date information regarding process standardization, generated by the employees of Royal BAM Group. For this reason, a basic set of questions is used for each interview, presented in Appendix D. Interviews are semi-structured providing both parties with flexibility to probe for details or discuss issues (Keller, 2019).

The selection of the interview participants was based on the criterion that different viewpoints should be obtained. For this reason, interviews are held with employees of BAM from different departments within BAM Netherlands. In a first stage, employees within the team of ONE BAM in Royal BAM Group NV in Bunnik were interviewed as they were more easily accessed and had the most direct knowledge regarding both issues of process standardization and the Uniform Project Approach initiative. It was observed that all of them had a positive attitude towards process standardization. Therefore, it was deemed necessary to search for employees that would be more skeptical towards it. Hence, in a second stage, interviews with employees from other departments within BAM Netherlands were held, who were suggested by my company's supervisor.

In total, 11 interviews were held with BAM employees working in the Netherlands. Variety was achieved regarding the aspects of job position, age, gender and working experience. Appendix D summarizes statements on determining factors on BPS drawn from all interviews.

4.4.4 Final statements - determining factors on BPS

By combining the statements retrieved from literature and interviews and checking for duplication, the final set of statements is derived.

Table 3: Final set of statements used for the Q-Sort

Final Statements
1. Processes with high repetition are suitable for standardization.
2. Non-routine processes are **not** suitable for standardization.
3. Processes with: 1) routine transactions across business units 2) limited value chain activities and 3) significant interdependencies, should be standardized.
4. All core value processes should be standardized.
5. High significance business processes should be standardized.
6. Processes that do not have significant impact on coordination should **not** be standardized.
7. Process standardization is **not** suitable when standardized products are not used.
8. Processes with high degree of input and output variety are **not** suitable for standardization.
9. Processes with low degree of input and output variety are suitable for standardization.
10. Processes with a moderate to high degree of maturity are suitable for standardization.
11. Predictable processes should be standardized.
12. A process with a high degree of uncertainty should **not** be standardized.

13. Processes with low degree of structuredness in their activities and sequence are **not** suitable for standardization.
14. Processes with high external risk should be standardized.
15. Complex business processes should **not** be standardized.
16. Processes demanding employees with medium to high work experience or tacit knowledge should **not** be standardized.
17. Operational skills and know-how obtained though practical experience are **not** suitable for standardization.
18. Processes that require employees to innovate are **not** suitable for standardization.
19. Processes that have to deal with explicit/procedural knowledge are suitable for standardization.
20. Processes with high number of participants are **not** suitable for standardization.
21. In a fragmented chain process, flexibility is needed; standardization is **not** suitable.
22. Standardization is suitable for processes with high degree of team interaction.
23. Processes that are interdependent across business units (e.g. resources) should be standardized.
24. Processes where local materials and labor have to be used should **not** be standardized.
25. Standardization **cannot** overcome the differences in regulations that different countries face (ex: legislations, financial regulations, import/export regulations, employment practices).
26. Processes that deal with local market conditions **cannot** be standardized.
27. In processes that concern local markets, standardization is possible if local changes are incorporated into the centralized standard.
28. Processes or process activities that affect customers the most should **not** be standardized.
29. Processes that concern relevant topics on every OpCo should be standardized.
30. Processes that deal with change should be standardized.
31. Processes that have an immediate impact on the company's or a project's profitability should be standardized.
32. Processes that deal with risk exposure reduction should be standardized.
33. Processes that deal with the supply chain should be standardized.
34. Processes with high risk should be standardized.
35. Processes which have high costs should be standardized.
36. Processes that deal with multiple functions/positions should be standardized.
37. Processes that are highly complex and are used a lot should be standardized,
38. Very simple processes with very high usage should **not** be standardized.
39. Wherever you have an interface with: 1) something that is very simple and very high usage with 2) something that is very complex, then you should standardize that simple thing.
40. Client feedback should be standardized but how you get that feedback should be open.
41. Quality, assurance checking processes should be standardized.

The 41 statements listed in Table 3 are used in the Q-sort procedure during the 3 workshops. Participants are asked to rank the statements in their order of preference – from mostly agree to mostly disagree – by answering to the sorting question "What is your opinion regarding the factors that influence process standardization? Please, rank the following statements from mostly agree to mostly disagree." .

4.5 The Q-sort procedure

The Q-sort was done in three workshops. In all of them, diversity was achieved in different aspects. After finishing the procedure, research participants were asked to answer a set of questions in order to obtain information about their background as well as better interpret their ranking of statements.

The workshops consisted of 32 employees in total. Figure 5 shows the division within the aspects of gender, job location, years of working experience and previous experience on process standardization. The illustration of the different job titles was difficult to be created due to the differences in the job titles across different departments; the same job attributes might be described with a different title.

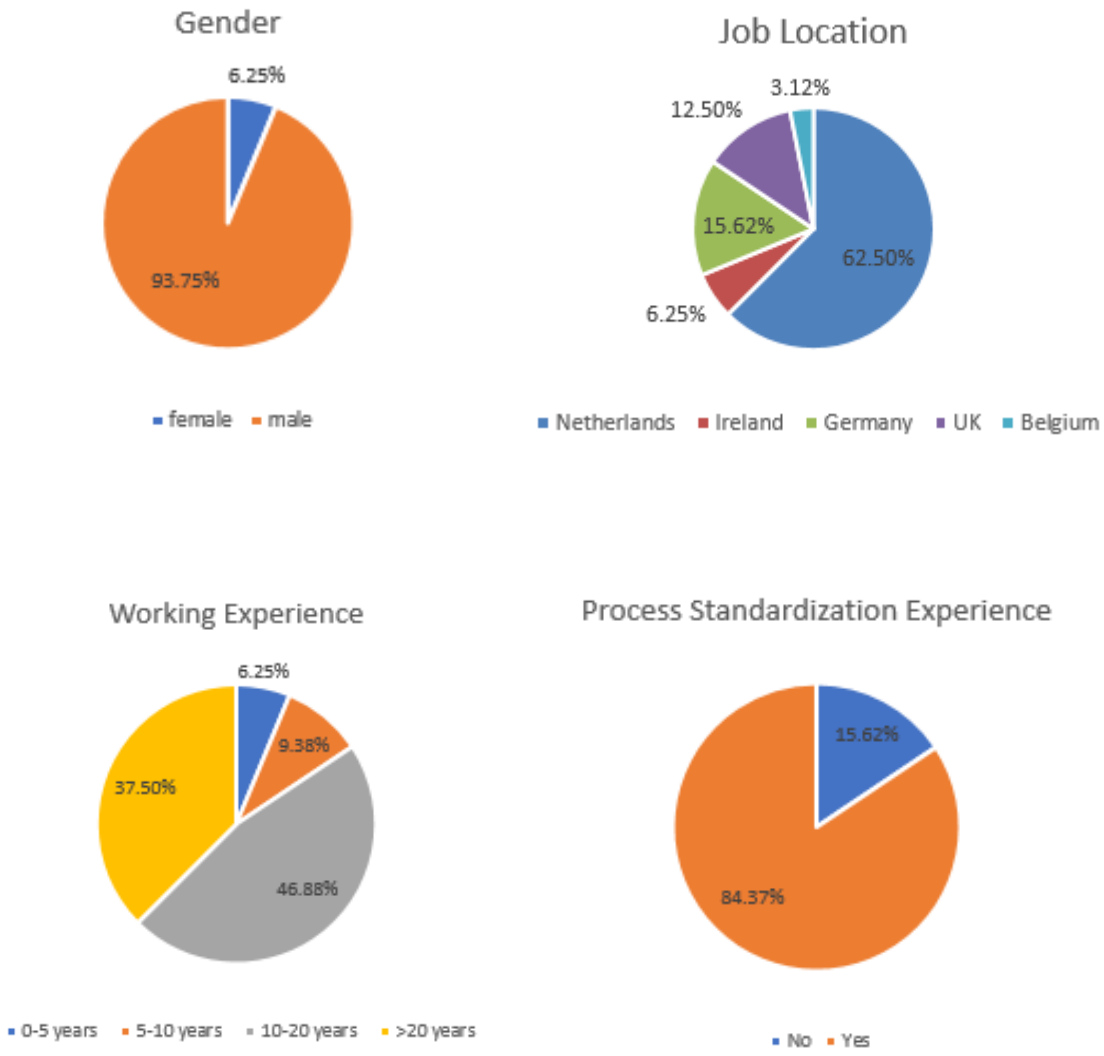


Figure 5: Distribution of gender, job location, working experience and past experience on process standardization

As can be seen from Figure **5**, gender diversity was not achieved, as the sample consisted of just 6.25% women (2 out of 32 participants). In general, the percentage of the female employees in the company is significantly lower than that of men so this distribution was expected. It was considered that it did not exert a big influence in the interpretation of the results though, or at least not as much as the other attributes.

Participants came from BAM UK, BAM Netherlands, BAM Ireland, BAM Germany and BAM Belgium. Most of them were working in BAM Netherlands as expected but diversity was achieved in the aspect of job location.

Finally, the majority of the participants have a lot of working experience. 48.8% have working experience 10-20 years and 37.5% more than 20 years. The views of people with less working experience (less than 10 years) were also a part of this research. Finally, 84,7% of the participants had previous experience on process standardization. However, all of them have worked with standardized processes so they do have knowledge on the topic.

The Q-sort procedure was done with card paper statements. The Q-grid table was printed on paper as well as the questions asked in the end. Questions during the workshop that were about the clarity of definitions that could be given different meanings were not answered. In that way, everyone interpreted the statements their own way.

4.6 Q-analysis – factor extraction

In order to extract factors from the data set, factor analysis is conducted with the help of the software PQMethod 2.35. Principal component analysis and Varimax rotation are used for the rotation and extraction of factors. In order to reach to the most accurate number of factors for later on interpretation, it is important that at least 2 significant Q-sorts are defining a factor (Brown, 1980). By that, it means:

- A Q-sort x is significant loaded at $P < 0.05$ on a factor y if it is loading $f_{xy} > 0.306$ and at $P < 0.01$ if loading $f_{xy} > 0.4$. ($x^*\sqrt{N}$, N=41, x=1.96 for $P < 0.05$ and x=2.58 for $P < 0.01$ (Van Exel & De Graaf, 2005))
- The highest square factor loading explains more than half of the common variance, $f^2 > h^2/2$ where h^2 is the sum of the squared factors loading of a Q-sort.

According to Webler et. Al. (2009), four criteria facilitate the decision behind the number of factors extracted:

1. *Simplicity*: Fewer factors are easier to interpret and link to different viewpoints. However, one should pay attention to not minimize the number of factors extracted to the degree that viable information from viewpoints is lost.
2. *Clarity*: Ideally, respondents load significantly on only one factor. That means that "con-founders" – participants that load significant on more than one factors – and "non-loaders" - participants that do not load on any factor – should be reduced. For the final results, in

order to incorporate more Q-sorts to the factor interpretation, wherever there was a confounder, the Q-sort was attributed to the factor that had higher loading.

3. *Distinctness*: This aspect refers to the degree of correlation between two factors. Low correlation between factors is desired. However, a higher correlation has its own share in the interpretation of the results and is not prohibited.
4. *Stability*: The comparison between the extracted factors should be enabling the clustering of certain groups as much as possible. In other words, the factors should be able to be attributed as viewpoints of certain groups of respondents.

Taking all the aforementioned into account, a 4 factor extraction solution is preferred.

5 Exploring perspectives on BPS drivers

Through the data analysis it has been concluded that four factors are ideally extracted from the obtained data set. In this chapter, every factor is translated into a common perspective on important aspects of BPS in the construction industry. Using information from the quantitative output of the data analysis – z-scores, distinguishing statements, q-sort values for statements and factor differences – as well as information provided from the set of respondents, characteristics are attributed to each factor.

High and low z-scores for each factor are visualized. For this purpose, aspects are categorized in 14 groups: frequency, strategic significance, risk, variety, structuredness, uncertainty, complexity, knowledge, interdependence, number of participants, clients, markets and innovation. Each z-score statement is visualized with a colored column matching the color of its corresponding category. When an aspect is followed by a negation of its effect on standardization – e.g. "complex business processes should not be standardized"- it is accompanied by a "(-)" in the visualization of the z-scores.

Frequency	Strategic Significance	Risk	Variety	Structuredness	Uncertainty	Complexity	Knowledge

Interdependence	Maturity level	Number of participants	Clients	Markets	Innovation	Distinguishing at P < 0.05	Distinguishing at P < 0.01
						*	**

Figure 6: Categories of aspects and their corresponding colour

Distinguishing statements have a greater significance for the translation of each factor into a perspective. Distinguishing statements are the ones that are ranked significantly different from one group to another. Hence, they constitute characteristic statements for each factor and determinant for its explanation. Statements marked with one asterisk (*) are different at a level of significance of P < 0.05 and those marked with two asterisks (**) are different at a level of P < 0.01. Appendix E summarizes the z-scores of each statement for all 4 perspectives.

In order to better interpret each factor, respondents were asked to fill in the reason why they ranked statements on the extreme edges of the Q-grid table. Each explanation is provided with a hashtag (#) and a number next to it, indicating the number of the corresponding respondent.

5.1 Perspective 1 – The UPA's engine

The first perspective, labelled "The UPA's engine", accounts for 22% of the explained variance in the data set. In total, 12 respondents share this view on process standardization in the construction industry. Figure 7 depicts the highest and lowest z-score statement rankings as well as the characterizing statements.

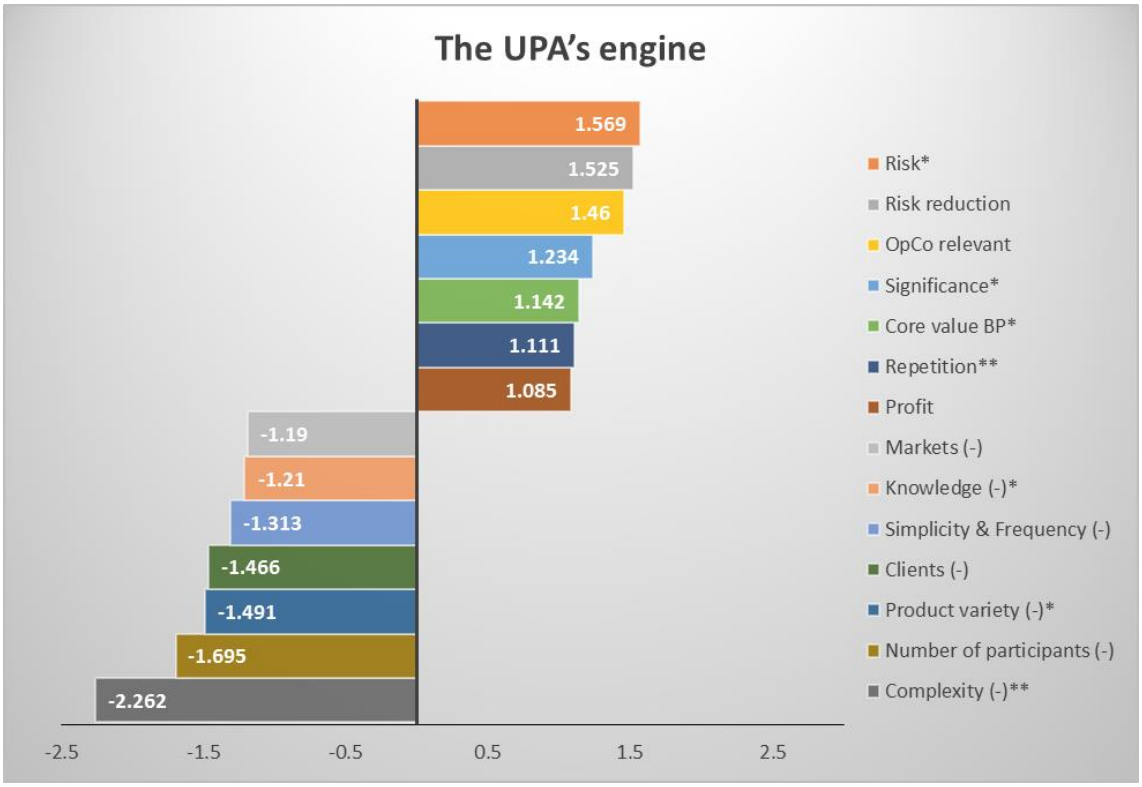


Figure 7: Perspective 1 – The UPA's engine

High ranked statements

The highest ranked statement for the respondents that loaded on factor 1 is about risk**. Processes with high risk and processes that deal with risk reduction are the most important aspects for process standardization according to the respondents of this perspective. Their decision is justified as "Risk standardization will mitigate risks" (#1) and since "high risk processes could have the greatest impact on the profitability and operations of BAM" (#24), risk standardization is considered very important.

Next in the ranking score is relevance across all OpCos. Respondents that loaded on this factor stated that "standardizing relevant topics on OpCos is a gain" (#29).

Respondents also ranked high statements regarding strategic significance**. In particular they believe that high significance BP and processes that deal with core values should be standardized.

Repetition (2)* seems to really matter for respondents of this factor, as they have highly ranked the statement "processes with high repetition are suitable for standardization", which is also a distinguishing statement that makes it a very important characteristic. Standardizing highly repetitive processes "seems obvious and will free up time for staff to undertake other tasks" (#28).

Direct impact on profit plays an important role for respondents of this perspective. The focus on the importance of impact is also implied by respondent's (#24) explanation on his ranking about risk, where he relates the reduction of risk to profit gains and hence indirectly rendering profit an important aspect of standardization as well.

Last but not least, the category of "interdependence" is listed quite high, with respondents stating that "high interdependence could result in loss of information" and hence, standardizing processes that are interdependent across business units would prevent such an effect.

Low ranked statements

Complexity is ranked the lowest, with the "non" statement "complex BP should not be standardized" being on the bottom of the respondents preferences. It is also a distinguishing statement, showing the strong opposition of the loaders of this factor on that. For the loaders of this factor, "complexity is a reason to standardize" (#1) and an organization "has a lot to gain if do so" (#24, #26). "Complex processes should be broken down into more simple processes/steps" (#28). Since it is a "non" statement, it could be translated as the string agreement of participants on the importance of standardizing complex processes.

Number of participants is ranked very low as well, with participants stating that "high number of participants means big risk of misunderstandings so standardization has a high benefit" (#15).

In the category of variety, respondents have listed product variety in very low preference. In particular, they state that "standardized products do not impact the process" (12). In accordance to that, another respondent has stated that "standardization is also possible when input and output varies, including product variety" (#18). Moreover, for this perspective, "integration does not necessarily mean using the same tools" (#24).

Loaders of this factor do not believe that processes that affect customers the most should not be standardized. In addition to that, they have ranked also low the statement "processes that deal with local markets cannot be standardized", showing that the category market and clients is not considered important.

Knowledge* aspects are low ranked, indicating that respondents of this factor do not consider tacit knowledge or work experience a road block for standardization.

Finally, frequency and simplicity are not considered an aspects that hold back standardization for this perspective. What is simple can easily be standardized and hence gain more from its standardization in combination with a high process frequency (#15, #26).

Interpretation

The perspective was named after the job location of the majority of this group. In particular, 7 out of 12 respondents are located in Bunnik, Netherlands, where the UPA standardization program is initiated. The fact that most of them were members of the UPA initiative could be

recognized in their preferences. More precisely, their high preference towards the standardization of risk, high significance processes, core values, direct impact on profit and OpCo topic relevance was anticipated. After a review on the distinguishing statements of this perspective it was observed that they distinguished on standardizing processes with high complexity as well as processes that deal with many functions. As the UPA's objective is to preserve the company's core values, maximize profit, reduce risk and "speak the same language" amongst all OpCos, the findings are more than explained. Their low rank towards knowledge, clients and markets as barriers towards standardization should be kept into consideration. Last but not least, the believe that processes that require employees to innovate are not barriers towards standardization, a fact that emphasizes their priorities towards process standardization.

5.2 Perspective 2 – Routine oriented coordinators

The second perspective, labelled "Routine oriented coordinators", accounts for 10% of the explained variance in the data set. In total, 5 respondents share this view on process standardization in the construction industry. Figure 8 depicts the highest and lowest z-score statement rankings as well as the characterizing statements.

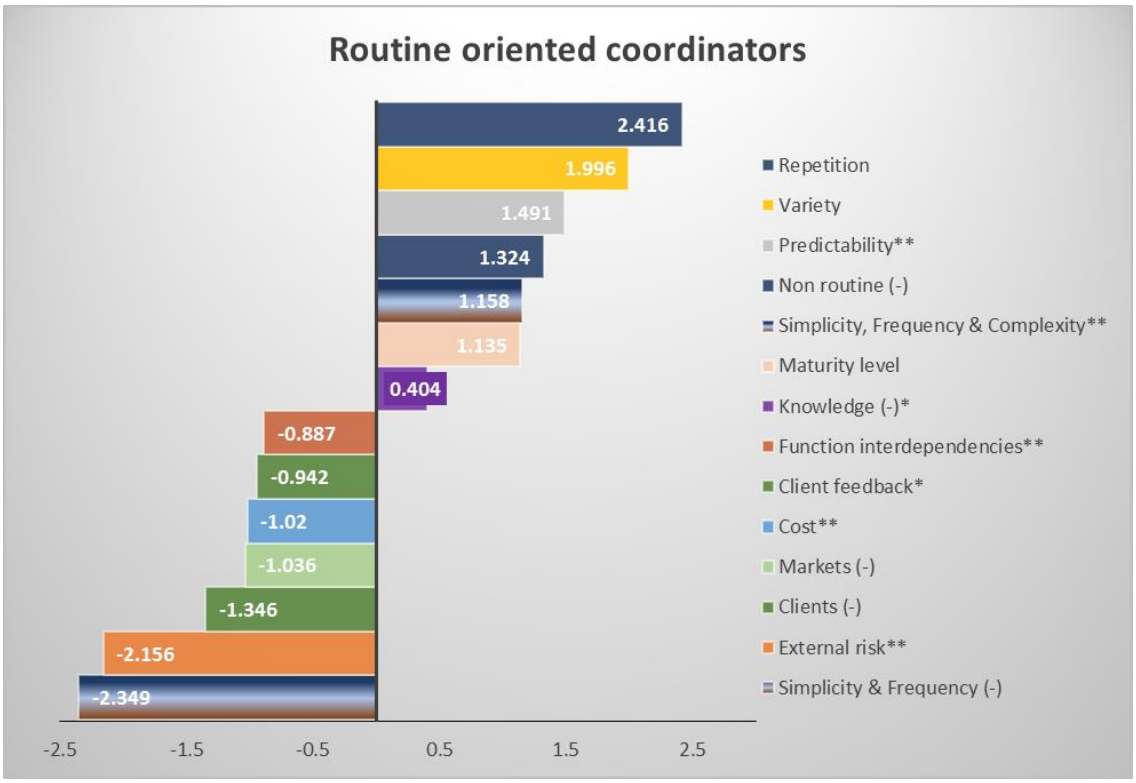


Figure 8: Perspective 2 – Routine oriented coordinators

<u>High ranked statements</u>

Process frequency – repetition is ranked on top of the preferences for this factor. Respondents have ranked in the first place a statement that indicates high repetition as suitable for standardization. Moreover, they have listed very high the statement "non routine processes are

not suitable for standardization", showing once again their strong preference over high frequency in process standardization. This view is enhanced by the high ranking of a distinguishing statement on simple, high frequency process standardization when combined with complexity. Standardizing processes with high repetition leads to a decrease in failure and an increase in project efficiency (#13), justifying the decision behind ranking process frequency that high.

Process variety* is very important for the respondents of factor 2, as they have ranked low input and output variety in the second highest place. This view is enhanced by the high ranking of two distinguishing statements that render low process structuredness and high input and output variety as very important barriers on process standardization. The lesser the variability, the higher the return on process standardization (#23).

Uncertainty plays an important role for respondents of this factor as well. It is distinguished that predictable processes should be standardized whereas high uncertainty processes should not.

Respondents believe that maturity level is important, as they have ranked the statement "processes with medium to high maturity level are suitable for standardization" quite high. High process maturity indicates a greater knowledge of what this process is about and how it works and hence its standardization is easier (#25).

Knowledge possesses a distinguishing, slightly high position on this perspective. More particular, respondents have a quite strong opinion that experience and "know-how" cannot be standardized in contrast to explicit knowledge.

Lastly, innovation whenever needed is considered just slightly important for this factor, with its respondents ranking the distinguishing statement "processes that need employees to innovate are not suitable for standardization" just above zero.

Low ranked statements

The lowest ranked statement on this factor is about frequency; it is a "non-non" statement that emphasizes the strong opinion of this perspective towards process frequency. This view is contradicting to an interviewee's opinion that very simple and very frequent tasks should not be standardized as the possibility of error is minimum and hence employees should be free to execute them in their personal way of working.

Risk seems to be a less important aspect for the respondents of this perspective. External risk is ranked on the second lowest place. As respondents state "they [external risks] are continuously changing and therefore the process cannot be standardized" (#25). "A tailored approach is preferred when dealing with high external risk" (#3). Statements about risk standardization are distinguishing statements that stand in the negative side of the rankings, indicating that risk is not such an important aspect for process standardization for this group as repeatability and variance.

Market and client aspects are also ranked low. Differences in local markets, labor and materials are of less importance for process standardization according to the respondents of this perspective.

Finally, high cost does not play a significant role on process standardization as respondents have loaded very low on the distinguishing statement "processes with high cost should be standardized".

Interpretation

The perspective was named after the job focus of the majority of this group as well as their strongest preferences. In particular, 3 out of 5 respondents have *business related* jobs. Their focus appears to be strongest towards the standardization of high repetition, routine, predictability, low input and output variety and low uncertainty. Hence, the perspective was named "routine oriented coordinators", emphasizing their strong preference towards routine and coordination aspects. Judging from their preferences as well as the distinguishing statements of this factor, it can be concluded that it is a perspective inclined towards stability; respondents prefer routine, predictability, low variety and high structuredness standardization whereas external risks, function interdependent processes and processes with high team interaction should not be standardized. Last but not least, respondents differentiate between operational, "know-how" knowledge and explicit knowledge, stating that the first type of knowledge cannot be standardized.

5.3 Perspective 3 – Non-localized top managers

The third perspective, labelled "Non-localized top managers", accounts for 15% of the explained variance in the data set. In total, 7 respondents share this view on process standardization in the construction industry.

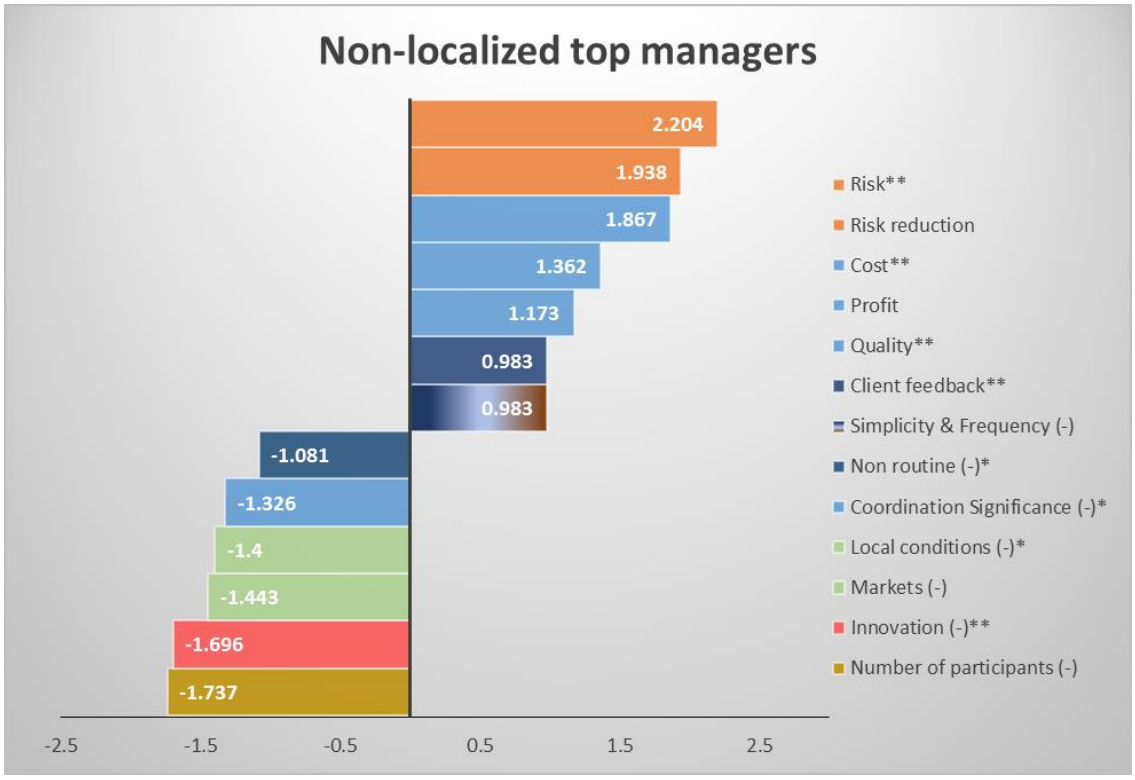


Figure 9: Perspective 3 – Non-localized top managers

High ranked statement

The highest ranked statement of this perspective is about risk, as encountered also in perspective 1. “Standardizing risk is the important thing in order to prevent bleeders” (#7) according to respondents of this perspective.

Next to that, respondents have ranked very high aspects of strategic significance. In particular, high cost, direct impact on profit and quality assurance checking are very important for process standardization according to loaders of this perspective. Processes regarding cost and profit are “business critical and their standardization would lead to enhanced ability to measure them” (#5). Regarding quality checking assurance, “if this is not standardized, learning , evaluating and predicted control is not possible” (#14).

Client related aspects are highly ranked as well. Respondents have stated that “industry is our OpCo which have specific clients and client requirements” (#6), indicating their high preference in standardizing client feedback.

Low ranked statements

Once again, as in perspective 2, very simple with high usage processes are not that important aspects to standardization according to the respondents of this factor. These minor processes have minimum impact on the organization. However, “if their standardization leads to higher

time efficiency, they should be taken into consideration" (#5). The fact that process frequency is of less importance for this perspective is enhanced by the low rank of the distinguishing statement "non routine processes should not be standardized".

Processes with high participant interaction is not a roadblock to standardization as well for the respondents of this perspective. Statement "processes with many participants are not suitable for standardization" is one of the lowest ranked of this perspective.

Number of participants in a process is the second lowest statement for this perspective. This view is also enhanced by the low rank of the aspect of coordination. In particular respondents do not believe that processes that do not have a significant impact on coordination should be left outside from standardization.

A distinguishing statement ranked really low is related to innovation. More specifically, loaders of this perspective have loaded low on "processes that need employers to innovate are not suitable for standardization", rendering innovation not that important in comparison with other factors. However, a respondent of this view has stated that "innovation must be standardized!" that could be explained as a different translation of the statement and more precisely, a translation of innovation as already acquired knowledge.

Aspects of market and clients are also ranked low in this perspective. Respondents do not believe that local market differences, local materials and labor impede process standardization. For this perspective, "processes have nothing to do with local market conditions" (#14).

Interpretation

The perspective was named after the job focus of the majority of this group as well as their job location diversity. In particular, 5 out of 7 respondents have top manager's job. Moreover, this group of respondents is the most diverse as far as job location is concerned; respondents work at Ireland, UK, Germany and Netherlands. Hence, the group was named "non-localized top managers". The strong preference of this group towards the standardization of risk, high cost processes, quality assurance checking, impact on profit and team interaction can be linked to the main focus of top managers; elimination of risk, increase in profit, preservation of quality, preservation of excellent client relations. Also, the fact that they translated "processes that require employees to innovate" as already acquired innovation – knowledge, reveals the different way of thinking with regard to the other groups. As far as their lowest preferences are concerned, this group does not regard differences in markets, countries regulations, customers and operational knowledge as barriers to process standardization.

5.4 Perspective 4 – Dutch "quality caring" designers

The fourth and last perspective, labelled "Dutch "quality caring" designers", accounts for 12% of the explained variance in the data set. In total, 5 respondents share this view on process standardization in the construction industry.

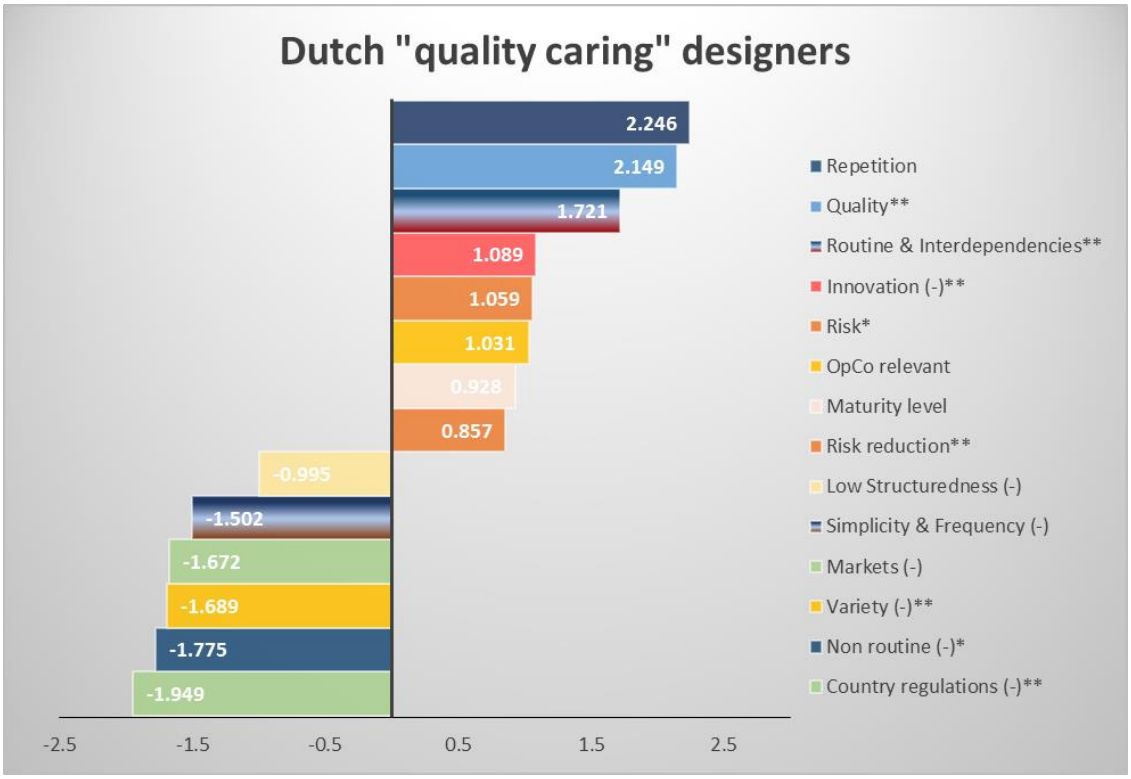


Figure 10: Perspective 4 – Dutch "quality caring" designers

High ranked statements

The aspect of frequency is on the top of the rankings for this perspective. Respondents of this aspect believe that "standardizing repetition speeds up the process". The combination of frequency and interdependencies across BU is also ranked high, and constitutes a distinguishing statement, enforcing the importance respondents acquire on these two aspects.

Following that, they have sorted quality assurance – a distinguishing statement – in the second highest place. "Quality of the deliverables is the most important thing" and that is why standardizing it would bring a lot of gains.

Innovation in processes where this is needed is respected by this set of respondents, as they have ranked the relevant statement very high and it constitutes a distinguishing statement as well.

Risk is considered very important for this perspective; it is a distinguishing statement and very high in the position of respondents' preference. "Standardizing risk is very important for higher management efficiency" (#16) according to respondents of this factor.

Last but not least, the attribute great importance to the relevance of topics on different OpCos, by ranking high the statement "processes with relevant topics on OpCos should be

standardized". Hence, interdependencies and similarities between OpCos is something important for this set of respondents.

Low ranked statements

Respondents of this perspectives find differences in regulations of different countries as the least important. In a less low rank but still low ranked, stands the statement "processes that deal with local markets cannot be standardized". "Local circumstances are never a reason to object to standardization" (#11). Therefore, respondents of perspective 4 do not attribute much importance on market differences.

Degree of frequency of a process is also something that respondents do not believe is of great impact as they have sorted it on the lowest rank. They believe that non routine processes do not affect that much the decision behind standardization. Moreover, a simple process that is encountered frequently should not be left outside from standardization.

Finally, input and output variety do not affect process standardization according to this factor.

Interpretation

The perspective was named after the job focus of the majority of this group, their job location as well as the perspective's main focus. In particular, 3 out of 5 respondents are design managers. All respondents are working in the Netherlands. Last but not least, this perspective is the only one that shows such a strong preference towards quality assurance checking standardization (it is on top of the rankings as well as a distinguishing statement). Combining all these information, the perspective was named "Dutch "quality caring" designers". Leaving room for flexibility wherever employees are required to innovate is a strong preference of this perspective as also expected from a design manager. Moreover, standardization of routine and interdependent processes could be explained from the fact that design managers have to deal with many interdependencies so a proper way to handle them is one of their main concerns. Risk standardization is also strongly preferred by this group. Client related processes should not be standardized according to this group. Once again, since design managers are dealing with client requirements, they attribute great importance in that aspect. Finally, they do not believe that markets and different countries' regulations are barriers to process standardization. Also, non-routine and high process variety are not implying that process standardization is not possible.

5.5 Correlation of perspectives

This chapter is investigating the correlation between each perspective. Table 4 illustrates the correlation among all perspectives as derived from the Q-analysis.

Table 4: Correlation between perspectives

Perspective	1	2	3	4
1	1.0000	0.2353	**0.6799**	**0.5788**
2	0.2353	1.0000	0.1535	0.2792
3	**0.6799**	0.1535	1.0000	0.4917
4	**0.5788**	0.2792	0.4917	1.0000

A correlation below 0.3 is considered weak, between 0.3 and 0.5 moderate and above 0.50 strong (Cohen, 1988). As can be observed from Table **4**, P1-P3 and P1-P4 are strongly correlated to each other. P3-P4 are characterized by a moderate correlation.

The case of a 3 factor analysis was then examined. However, it was immediately rejected, as it was using only 19 out of 32 q-sorts, whereas a 4 factor analysis was using 29 out of 32 q-sorts. Moreover, the 4 factor analysis did reveal a distinguishing group – that of Dutch quality caring designers – which was missing from the 3 factor analysis.

5.5.1 P1 - P3

P1 and P3 have strong similarities; in both perspectives respondents rank high on risk and strategic significance aspects. Strong similarities were actually anticipated as "the UPA's engine" and top managers have some quite similar goals. However, there are also differences that led to the decision of keeping both aspects. The most important difference detected concerns the aspect of innovation. In particular, respondents of P3 have ranked the statement "processes that need employees to innovate should not be standardized" in one of the lowest places. Moreover, it is a distinguishing statement for this perspective, rendering it even more important. Respondents from P1 however have not attributed that much focus on innovation. Furthermore, respondents of P1 believe that complexity is a very important aspect of standardization, ranking the distinguishing statement "complex business processes should not be standardized" in the lowest place. Respondents in P3 on the other hand, have a less strong perception towards complexity. Last but not least, although both perspectives attribute high importance on strategic significance aspects, only P1 ranks significantly and very high in standardizing all core value activities, whereas for P3, that is not of such importance. Standardizing processes with high cost is also highly differing between the two perspectives; for P3 it is a distinguishing and highly important aspect whereas for P1 it is not of such importance.

5.5.2 P1 – P4

The biggest difference between P1 and P4 stands for the aspect of market. In particular, P4 has ranked the distinguishing statement "standardization cannot overcome differences in regulations of different countries" in the lowest place, indicating that market differences are not an obstacle for respondents of P4, whereas for respondents of P1 this is rather a neutral aspect. Moreover, P1 views profit as an aspect of great importance for standardization in contrast to P4 that does not agree that much with that. Quality is of great significance for P4 whereas P1 ranks that in a less strong position. Finally, it seems that respondents of P1 have a very strong view on knowledge. In fact, they strongly believe that knowledge (operational knowledge, tacit

knowledge and know-how) does not constitute a barrier towards process standardization, in contrast to P1 that has formulated a less strong perception around it. The aforementioned in combination with the distinction of 2 different groups – "the UPA's engine" and "Dutch "quality caring" designers" - has led to the decision of keeping both factors.

5.5.3 P2

P2 is the only perspective that stresses that much the importance of repetition, predictability, similarity and knowledge. In contrast to the other perspectives, P2 ranks on top these aspects instead of risk and strategic significance. Moreover, respondents of this aspect are the only ones that consider knowledge a barrier an aspect to not standardize – when it comes to operational and know-how knowledge. Finally, external risks and change should not be standardized because – as they have stated in their reflective answers – those aspects are dynamic and constantly changing. For these reasons P2 is a factor that stands alone from the other 3 perspectives.

5.6 Summary

In total 4 factors were extracted from the Q-analysis. A 3 factor solution was also examined but rejected due to the reasons stated in section 5.5; the small number of q-sorts used (19/32) and the fact that it is missing a distinguishing factor group which is present in the 4 factor analysis.

The 4 factors are: 1) the UPA's engine, 2) routine oriented coordinators, 3) non-localized top managers and 4) Dutch "quality caring" designers. The four perspectives stress the most important factors regarding process standardization according to this set of groups. The identification of different perspectives around process standardization is a way to understand that people working under the same roof share different views on what is most and least important regarding process standardization. The findings can be used in order to be better prepared on what those groups are expecting from a standardization initiative and perform a smoother implementation. It should be noted that since the sample consisted of just managerial jobs and none of the participants was occupied in engineering/ operator jobs, the usability of the perspectives is limited.

As depicted in Figure 11, the correlation is strong between P1-P3 and P1-P4. Both P1 and P4 agree highly on standardizing risky processes, processes of strategic significance, processes that have an impact on profit and interdependent processes across BU. P1 and P4 correlate strongly in standardizing high risk, processes with high complexity and usage as well as processes that are very simple and highly used. All 4 perspectives correlate in the following: high process maturity facilitates process standardization, explicit knowledge is not suitable for standardization and lastly, local materials and local markets are not a barrier towards standardization.

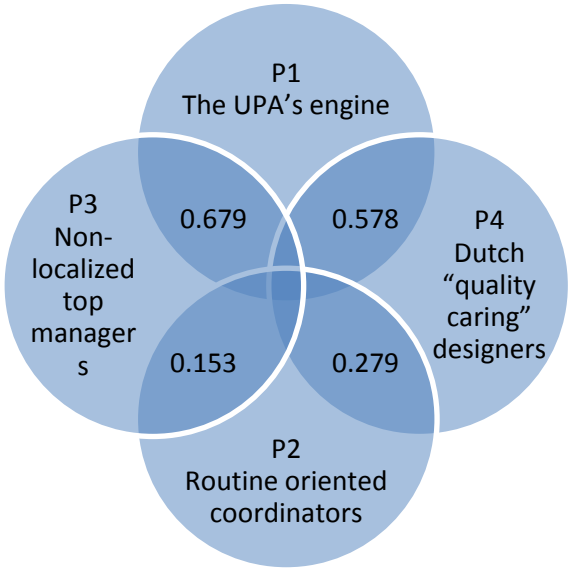


Figure 11: Visualization of the correlation between perspectives

6 Determining factors of BPS for Royal BAM Group

By combining all information provided from the 4 extracted perspectives in section 6 and the reflective answers of respondents, factors that affect process standardization in the context of Royal Bam Group are determined. Table **5** describes the factors with their corresponding dimension scale, their impact on process standardization as well as the perspective from which they derived. The effect of each factor on process standardization is defined by "Yes", "No" and "NA" (not affecting). Appendix E illustrates the mean Z scores of all 4 factors.

Table 5: Determining factors on process standardization for Royal BAM Group

Factors	Scale	Standardization	Perspective
Repetition	High Low	Suitable NA	P1, P2, P4
Routine	High Low	Suitable NA	P1, P3, P4
Routine & Interdependencies	-	Yes	P1, P2, P3, P4
BU Interdependent	-	Yes	P1, P4
Number of Participants	High Low	Yes NA	P1, P2, P3, P4
OpCo topic relevance	High Low	Yes NA	P1, P2, P3, P4
Significance	High Low	Yes NA	P1, P2, P3, P4
Core Value	-	Yes	P1, P4
Profit impact	-	Yes	P1, P3
Cost	High Low	Yes No	P3 P2
Quality assurance checking	-	Yes	P1, P2, P3, P4
Type of product	Standard Non-standard	Facilitated NA	P1, P2, P3, P4
Input-Output Variety	High Low	NA Suitable	P1, P3, P4 P2
Uncertainty	High Low	- Yes	P2, P3
Risk	High Low	Yes -	P1, P2, P4
Risk reduction	-	Yes	P1, P3, P4
External risk	-	No	P2
Complexity	High Low	Yes -	P1, P3, P4
Routine & very Simple	-	Yes	P1, P2, P3, P4
Knowledge*	Explicit	-	

	Tacit, medium-high work experience	NA	P1, P2, P3, P4
Innovation	Already acquired	Yes	P3
	In process	No	P4

All perspectives have loaded positive and high on repetition, with the exception of P3 that placed the corresponding statement in a slightly low (z=-0.210) position. However, since it is a relative method, it was concluded that respondents of P3 do not believe that routine processes are not suitable for standardization but rather that they attribute more significance to other aspects.

Non-routine processes do not affect standardization initiatives according to the explanations of respondents of P1, P3 and P4 and the distinguishing ranking on the respective statement. Only in P2 was the statement "non routine processes are not suitable for standardization" slightly low ranked. However, it was not a distinguishing statement and there was no mention of that in the explanations of the respondents. Therefore, it was concluded that highly routine processes should be standardized and that low-routine does not hamper the standardization of the respective process.

Interdependent processes across BU are ranked positively in favor of standardization. As respondents have stated, by standardizing interdependent processes, losses due to handovers are eliminated. In addition, a routine process that also holds interdependencies should be standardized, a conclusion supported by the positive ranking of all perspectives and the high ranking of P4.

According to respondents, the higher the number of participants in a process, the bigger the benefit gained from its standardization, as the risk of errors due to misunderstandings is significantly reduced.

Processes that concern relevant topics for every OpCo are ranked positive in favor of process standardization by every perspective. Thus, it is concluded that they should be standardized.

Process significance is ranked positive by all perspectives and constitutes one of the highest (distinguishing) ranked statements of P1. Hence, processes with high significance should be standardized.

In the same context, processes that are under the umbrella of strategic significance – core value processes, processes with profit impact, costly processes and quality assurance checking processes - are positively affected towards process standardization. Every perspective has responded positively regarding process standardization when it comes to these aspects, with the aspect of cost being the only exception. More specifically, for P3, the statement "processes with high costs should be standardized" was ranked low. However, respondents did not refer to that aspect in their reflective responses. They did state though that if it is not urgent to standardize the process, you have no benefit from doing so. Hence, standardizing low cost processes does not provide any benefit to the organization and hence they should be left intact.

Type of product – standardized or non-standardized – is seen as non-significant for the decision behind process standardization by every perspective.

Input-output variety is not a pre-requisite for process standardization according to the respondents. However, similarities are a reason to standardize for them and hence, it is concluded that processes with low input and output variety should be standardized.

Uncertainty is an aspect that did not receive consensus by the majority of respondents. More precisely, predictable processes or else, processes with low uncertainty, should be standardized as stated by all perspectives. Regarding processes with high uncertainty though, no clear answer is provided.

Risk is considered a reason to standardize according to the majority of respondents. When it comes to processes that deal with external risk though, it is concluded that they are such dynamic processes that standardizing them would not bring about benefits.

Complexity is not a road blocker for process standardization. In particular, respondents have stated that complex processes are the ones that need to be standardized; they need to be broken down to more simple steps and then proceed to the standardization of these steps.

Routine & very simple should be standardized according to respondents from every perspective. In fact, respondents have stated that "what is simple is easy to be standardized and when it is highly used, the benefits gained from its standardization are even higher.

Regarding the aspect of knowledge, every aspect ranked it in a slightly low place, indicating that tacit knowledge and knowledge obtained through work experience do not hamper process standardization. As far as explicit knowledge is concerned, it was noticed that a number of participants did not know the meaning of the word "explicit" during the workshops held for the Q-sorting and thus it was deemed more wise to not draw any conclusions about that.

Innovation was translated in different ways from the set of respondents. Respondents from P4 – mostly design managers – attributed a great importance on letting processes that require employees to innovate intact from process standardization. In particular, it is stated that "standardization should not be implemented if flexibility is a fundamental requirement". Respondents from P3 though have stated that "innovation must be standardized", showing that they translate innovation as something already acquired.

Medium to high maturity level is a consensus statement for all perspectives, indicating that it is enabling process standardization. Low maturity level though does not mean that process standardization is impeded.

Level of process structuredness or documentation are found to be enabling process standardization as well and hence they are working as moderators.

Aspects concerning local markets, local materials and labor do not determine whether a process should be standardized or not according to all 4 perspectives. In fact, some of the respondents stated that “local circumstances are never a reason to object to standardization” and “a process has nothing to do with local differences”.

Conclusions could not be drawn regarding processes that affect customers the most. According to P1, P2 and P3, client related aspects do not affect process standardization. The explanation provided by the corresponding respondents was that the organization’s clients are its OpCos and thus, standardizing relevant to clients processes would not harm the organization. However, as respondents from P4 stated, dealing with customers depends a lot on personal relationships and judgement and client experience is very specific. Hence, according to them client related aspects should not be standardized.

Finally, no conclusions were drawn regarding processes dealing with change as the corresponding statement was not high or low ranked in any of the perspectives, nor did the perspectives match in their preference. For respondents of P1 for example, change should be standardized according to a reflective response whereas for P4, change cannot be standardized.

By combining the information provided in Table 5 and Appendix E , a model proposing factors that indicate a process suitable for standardization, a process that should be standardized, a process that should not be standardized as well as factors that work as moderators of process standardization is created. This model is the result of the common beliefs of all perspectives, as illustrated in Appendix E that shows the mean Z scores of all factors.

Figure 12 illustrates factors that are found to be suitable for standardization, factors that should be standardized, moderating factors as well as “don’t” factors for process standardization, as concluded from the research analysis. The arrows indicate the degree of the corresponding dimension of each factor.

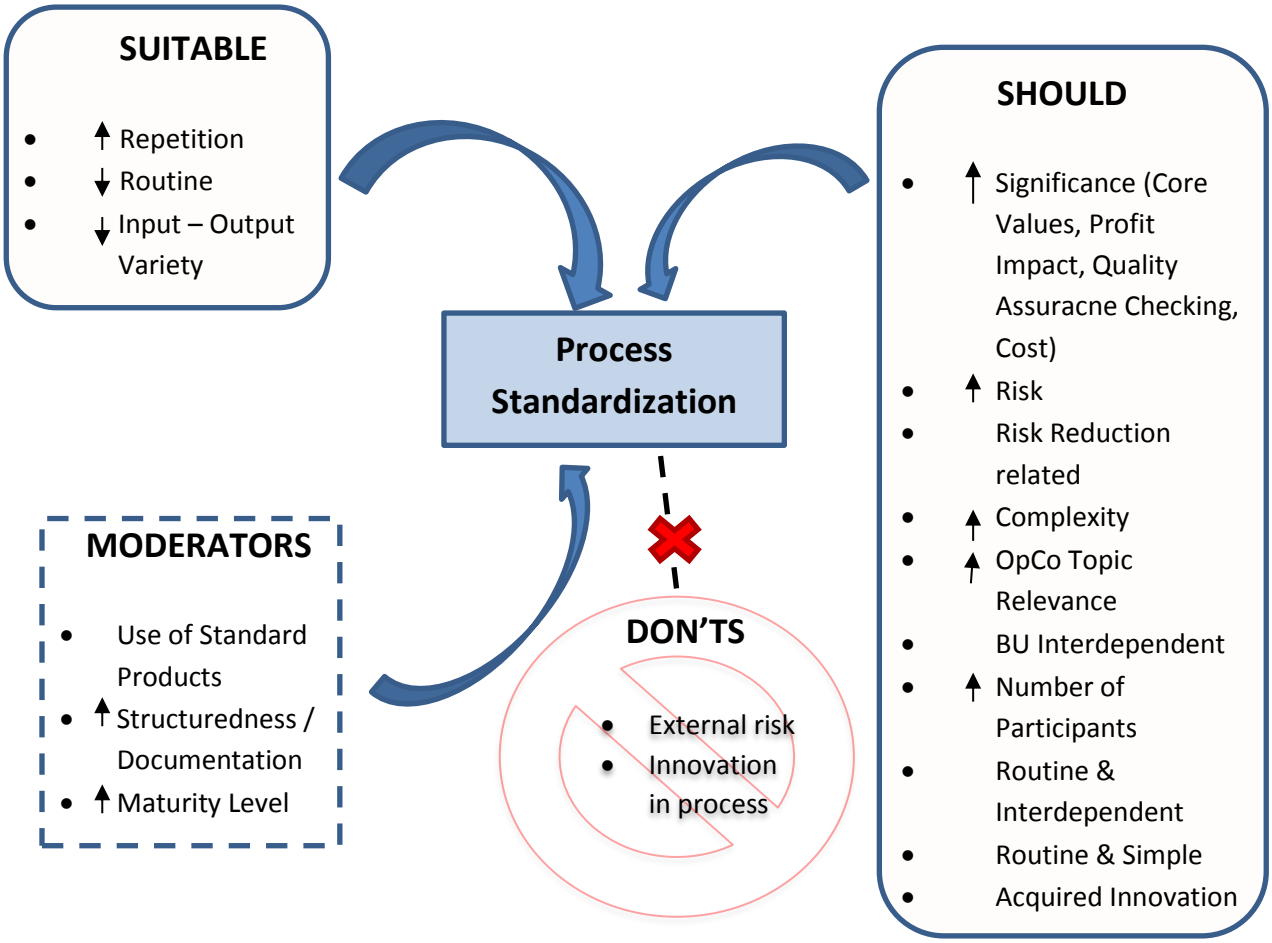


Figure 12: Process standardization factor visualization

6.1 Validation of the proposed factor model

The proposed factor model as given in Figure 12 was validated through interviews with experts from Royal BAM Group. The experts were chosen in accordance to the following criteria:

- They should not have been included in the research and the Q-sort.
- They should have knowledge around standardization.
- They should have knowledge around the UPA initiative.

Interviewees were asked to provide a ranking to each of the proposed factors, ranging from 1 to 5, with 1 being the least important and 5 the most important for them. The score of each factor as well as the total sum are illustrated in Table 6.

Table 6: Rating of the proposed "should be standardized" factors.

"Should" factors	Interviewee I	Interviewee II	Interviewee III	SUM
Significance	5	5	5	5
Risk	5	5	4	4.7
Risk reduction	5	5	3	4.3
Complexity	3	3	3	3
OpCo topic Relevance	2	2	4	2.7
BU Interdependent	2	2	2	2
Number of participants	2	2	2	2
Routine & Interdependent	4	2	4	3.3
Routine & Simple	4	2	1	2.3
Acquired Innovation	1	3	4	2.7

The following sub-sections elaborate on each interviewee's observations around the proposed model.

6.1.1 Observations from interviewee I

The first interviewee agreed upon all proposed factors under the "should" column. As stated, the distinction between factors that are suitable for standardization and the ones that should be standardized is a big benefit for the company. "People want some kind of standardization, they do not want to re-invent the wheel but they do not know what to standardize exactly. So, I think it is a good starting point.".

What is said to be missing from the model is: a distinction between the different types of complexity and a supply chain related factor. Interviewee was asked if IT related factors or the factor of urgency was missing, as stated by the participants of the Q-sort. The response was negative. In particular, IT is considered too difficult to standardize so the interviewee did not think about adding this factor. Moreover, the factor of urgency is incorporated in the factors of significance and risk, rendering it unnecessary.

About the contribution of the model to the continuation of the UPA initiative, it was stated that the model could be used in order to determine what have different groups identified as more important for them, create a consensus and prioritize the factors that point out a process to be standardized for the whole company. It is important to provide the same goal to everyone to work on and hence consensus around the factors that determine whether a process should be standardized.

6.1.2 Observations from interviewee II

The second interviewee agreed upon all proposed factors as well. IT related factors are moderators and hence, not something that should be considered to be standardized. The sense of urgency is incorporated in the factor of significance for this interviewee as well.

Interviewee showed objection to the factor of risk. More precisely, it was stated that not only high risk but low risk processes should be standardized as well. As the interviewee said : “For me it is very important that you standardize even low risk because the profit of a project that you are risking when you don’t (i.e. when you don’t standardize even low risk) is very large.”. Moreover, an objection was made about external risk. As stated, even processes with external risks should have a degree of standardization in the form of predicting risks and proposing mitigating actions. More precisely, “there should be a process in advance that is suggesting what kind of risk could occur. That should be done in a standard way, so predicting some risks and their mitigating factors.”.

As far as the contribution to the continuation of UPA, it was stated that “theory and practice are getting together and this is a good way to define whether we have relevant factors or not, whether we should standardize or not.”. The model is also “balancing the unique or standardization”.

6.1.3 Observations from interviewee II

The third and last interviewee agreed upon all suggested factors. Moreover, he could not define a missing factor to the model.

About the benefits of the model to the continuation of UPA, the interviewee first stated that it provides to employees a good insight to why UPA is taking place. Moreover, “Some people only look at things from their perspective but when you show them evidence (i.e. the results from your research) it maybe conveys the message better. “. Since it is not top management but “junior” people that drive the business day to day, their perspectives should be taken into account as well.

PART IV

CONCLUSIONS - RECOMMENDATIONS

7 Discussion & Limitations

In this chapter, the determining factors for BPS derived from the Q-analysis are discussed and compared to the theoretical conceptual framework proposed in section 3.4. After that, limitations from the theoretical framework and the research are elaborated.

7.1 Comparison with theoretical conceptual framework of BPS drivers

Table 7 provides a comparison between the results that stemmed from the research and the theoretical framework.

Table 7: Comparison between Q-methodology and theoretical framework's results on process standardization

Factors	Scale	Standardization	
		Research	Theoretical framework
Repetition	High	Yes	Yes
	Low	NA	No
Routine	High	Yes	Yes
	Low	NA	No
Routine & Interdependencies	-	Yes	Not suited when interdependence is strong
BU Interdependent	-	Yes	No
Number of Participants	High	Yes	No
	Low	NA	-
OpCo topic relevance	High	Yes	Yes
	Low	NA	-
Significance	High	Yes	Yes
	Low	NA	-
Core Value	-	Yes	-
Profit impact	-	Yes	-
Cost	High	Yes	-
	Low	No	-
Quality assurance checking	-	Yes	-
Type of product	Standard	Facilitated	Facilitated
	Non-standard	NA	NA
Input-Output Variety	High	NA	No
	Low	Facilitated	Yes
Uncertainty	High	-	No
	Low	Yes	Yes
Risk	High	Yes	-
	Low	-	-
Risk reduction	-	Yes	-
External risk	-	No	-
Complexity	High	Yes	No
	Low	-	Yes

Routine & very Simple	-	Yes	Depends on Significance
Knowledge*	Explicit	-	Yes (documentation)
	Tacit, medium-high work experience	NA	No
Innovation	Already acquired	Yes	-
	In process	No	No

Both literature and Q-methodology coincide on the factors of repetition and routine. In particular, both sources indicate that a process with high repetition and routine should be standardized. However, when dealing with low routine and repetition, Q-analysis proposes that process standardization is not affected and is dependent on other factors whereas literature suggests that it should be avoided. As stated by Rosenkranz et al. (2010), non-routine processes are not applicable to standardization as different parts of the process might need creativity and hence flexibility is required.

High interdependencies are hampering process standardization according to literature (Wullenweber et al., 2008) in contrast to Q-methodology's results. In the same context, high complexity is impeding process standardization according to Wullenweber et al. (2018). Low interdependencies and/or low complexity though are enabling standardization.

Routine and very simple processes lead to process standardization according to Q-method's results whereas according to literature, this is the case only if combined with the aspect of significance and/or urgency. If it is not important/urgent to standardize, personal differences on the way of working should be respected (Romero et al. 2015) , even if they lead to output differences.

Regarding process maturity level, both methods concluded that processes with at least a moderate level of process maturity enable process standardization (Rosenkranz et al., 2010). None of the methods indicate that low maturity hinders process standardization. Hence, low process maturity means that process standardization is dependent on other factors.

The most significant difference detected was about markets and clients. In particular, from literature it is concluded that differences in legal requirements of different countries, differences in national or regional culture, potential resource constraints or differences in products and services encountered in different locations, customer expectations, market maturity and local market conditions (Romero et al. 2015, Tregear 2010a) are barriers for process standardization. As Münstermann (2010) states, over standardizing across an organization's functional and geographical structure might result in undesirable outcomes and prevent meeting local requirements. Results stemmed from perspectives and participants' reflective responses though indicate that differences in markets and different locations do not affect process standardization.

It should me mentioned that respondents stated that they missed IT related aspects from the statements during Q-sorting. IT related factors were not included in the research, hence a comparison between theory and practice cannot be made for this factor.

As far as the aspect of change is concerned, there was not a clear conclusion from neither the Q-analysis nor literature. However, literature suggests that when encountering environmental instability and uncertainty, process standardization is not suited.

7.2 Limitations of the theoretical framework

The theoretical framework of process standardization was build up by literature concerning business process standardization. Literature concerning standardization in the construction industry is scarce, let alone when focusing only on a part of standardization in the construction industry; process standardization. Hence, the research was built by statements drawn for a business and not exclusively for the construction industry.

Moreover, literature concerning the barriers of implementing standardization in the construction industry was not focused only in the domain of process standardization. Therefore, there might be some aspects that do not necessarily fall under the umbrella of process standardization.

7.3 Limitations of the research analysis

The main limitation of the research analysis is the limited generalizability it bears. The research was conducted in the context of Royal Bam Group and hence, all research participants are part of the company. As a consequence, generalizing the results by referring to the "construction industry" as a whole is not valid.

Furthermore, the sample of participants that conducted the Q-sort was not diverse enough. To start with, there were only two women participating in the Q-sort out of the 32 participants (6.25%). The low percentage of women working in the company in comparison with men, combined with the difficulty to allure employees to participate in the Q-sort led to the aforementioned low percentage of women in the research. However, gender is not such an important aspect of the research.

Job diversity is the most important aspect of the research in order to link the perspectives to the different "job groups". The fact that most participants stemmed from top managerial jobs indicate that more diversity in this aspect could have been achieved. The fact that there were no participants from engineering/operators jobs is a limitation of the q-sort. In fact, perspectives could only cover groups within managerial jobs. However, time constraints did not provide the opportunity to gather more participants by organizing other workshops and bridge this diversity gap.

Limitations are encountered in the statements used in the Q-set as well. More precisely, it was indicated by participants of the Q-sort that statements were not discerned in every PLC phase as well as the various construction sectors (infrastructure, building, marine, etc.) which would have provided more specific results. Moreover, IT related factors were missing from the statements.

Finally, reflective answers were given through written short questions after filling the Q-sort. Did not have the opportunity to interview the respondents in person and evaluate their preferences more in depth. Some of the participants did not provide satisfying responses, they did not

respond accurately to the corresponding questions and others skipped the section of answering the questions.

7.4 Practical Contribution

In order to identify the strengths, weaknesses, opportunities and threats of the proposed model, a SWOT analysis is presented in Figure 13. This will also provide an insight on the future application of the model to the continuation of UPA in Royal BAM Group.

Internal	**Strengths**	**Weaknesses**
	○ Clear distinction between factors that define if a process should or should not be standardized. ○ The factors derived through perspectives of employees' of Royal BAM Group and hence their opinion is highly considered. ○ Literature and interviews were used for the research, combining both theory and practice.	○ Results are not quantitative and hence there is no weight distinction between the factors. ○ There is interrelation between the proposed factors.
External	**Opportunities**	**Threats**
	○ Continuation of an internal standardization initiative (UPA).	○ Possible objections to the proposed factors. ○ Client demand on standardization might affect the proposed factor model.

Figure 13: SWOT analysis for the proposed factors – model

<u>Strengths</u>

- The model has a clear distinction between factors that define if a process should or should not be standardized as well as the ones that are working as moderators of process standardization. Hence, employees of Royal BAM Group will be able to identify relevant factors in their processes and come a step closer to stop re-inventing the wheel.

- The factors derived through perspectives of employees' of Royal BAM Group and hence their opinion is highly considered. When properly presented, different perspectives around which factors define a process that should be standardized will be shared, discussed, understood by every group and continue with the required consensus.
- Literature and interviews were used for the research, combining both theory and practice. As literature on process standardization in the construction industry is scarce, sources from business process standardization were mainly used. Thus, a comparison between business and construction process standardization is made. Moreover, literature findings were enriched with experts knowledge and experience provided through interviews.

Weaknesses

- Results are not quantitative but rather distinguish between factors that determine processes suitable to be standardized from the ones that should be standardized and the ones that should be left unique. There is no weight of significance between the factors. When proceeding with the UPA initiative and the standardization of certain processes, it is expected that the transformation of the already existing processes will take place gradually. As a consequence, employees of Royal BAM Group might have trouble finding out a hierarchy of the factors in implementing the proposed model.
- The factors proposed under the "should" column of the model are interrelated. To provide an example, standardizing quality assurance checking, costly processes, risk and complexity is a way to ascertain profit. Listing these interrelations could provide a more precise and solid guideline for process standardization.

Opportunities

- The Uniform Project Approach (UPA) that has started in Royal BAM Group since early 2019 is facilitated through the proposal of the factors that determine processes suitable for standardization, processes that should be standardized, processes that should stay unique and moderators of process standardization. As also stated in one of the validation interviews, "people want some kind of standardization, they do not want to re-invent the wheel but they do not know what to standardize exactly" (Interviewee I). Hence, the model is a good starting point in order to reach to the objective of UPA.

Threats

- A threat that is very much likely to occur is the objection to the proposed factors by groups of employees. This might happen for two reasons. First, people might think differently on some factors according to their job position or background (job experience, culture, ability to embrace change). Second, objections might occur if the model is proposed by an external source. As stated in section 3.3.2 "when a best practice stems from external of the focal organization source, employees usually show reluctance or even denial that leads to slower or inefficient adoption" (Björn Münstermann, 2010); a phenomenon called "not invented

here" syndrome according to Leijen (2005). The way the model will be presented plays a great role in how people will embrace it.

- Although research results have shown that client and markets are not impeding factors of process standardization for Royal BAM Group, the issues gathered per PLC stage and their root causes – as depicted in Figure 4, indicate that a source of bad performance is client requirements misalignment from the one side and too much focus on client's needs from the other side. Hence, the right balance between client requirements and process standardization should be aimed for. In order to do so, the model might need adjustments in processes or process steps that are too much client oriented.

7.5 Scientific Contribution

This research contributed to the scientific knowledge by pointing out the needs of process standardization in the construction industry. This was achieved through the identification of 4 different perspectives around process standardization within and across all business units of a construction company. Since the first step of this research was a literature review on business process standardization, it was observed that literature was scarce when focusing on process standardization in the construction industry. Hence, this research provides more knowledge on this field and calls for more research around this topic.

Furthermore, as stated in 1.2, the critical factors that determine the desired degree of process standardization are not known. Thus, more research is needed in order for the construction industry take advantage of process standardization. This research proposes a model with the factors that determine whether a process is suitable for standardization, whether it should be standardized or not and last but not least, whether a factor is working as a facilitator of process standardization.

Recommendations for future research are listed in Section 9.2, pointing out areas of research that are either a continuation of this thesis's findings or fields that could not be researched due to time constraints.

8 Conclusions

This chapter provides answers to the research questions as formed in section 2.2. First, sub questions are answered in section .

1. What does process standardization mean and why has it not been fully implemented yet in the construction industry?

The answer to the 1st sub-question is provided by answering the following questions:

1.1 What is the impact of process standardization on a business?

Business process standardization has an effect on:

- Process performance (+)
- Process time (-)
- Process cost (+/-)
- Process quality (+)
- Process flexibility (+/-)
- Process control (+)
- Process outsourcing, success & readiness (+)
- Global integration (+)
- Compliance with regulations (+)
- Customer confidence (+)
- Collaboration (+)
- Solve conflicts & ensure consensus (+)
- Technical interchangeability (+)
- Creativity (+/-)
- Learning effect (+)
- Economies of scale (+)

Standardization affects process flexibility and creativity both in a positive and a negative way, showing that a right balance should be opted in order to achieve the desired results for these aspects. The double effect of standardization in process cost depends on the balance between process standardization's cost effectiveness and investment costs.

1.2 What are the drivers of business process standardization?

The drivers of business process standardization are discerned into 5 groups:

Factors	Elements
Managerial factors	Managerial practice, Top management support
Process related factors	Level of routine & structuredness, Input-Output variety, Process type, Process documentation, Internal/External sources of BPS definition, Enforceability, Personal differences, Process Complexity, Degree of Interdependence
Firm related factors	Organizational structure, Corporate governance, Different locations, Resources constraints, Product/Services variety, BPM Capability, BPS initiative execution excellence, Business – IT alignment
IT related factors	IT capabilities & usage, Software/System introduction, IT landscape variety/architecture
External factors	Industry/Market imperatives, Legal requirements, Environmental risks, Relationship characteristics

Relational governance, contractual governance, process control, knowledge management and organizational learning work as mediators of business process standardization.

IT intensity and organizational culture work as moderators of process control and IT related factors respectively towards process standardization.

1.3 What are the challenges and barriers of the implementation of standardization in the construction industry?

The challenges and barriers of the implementation of standardization in the construction industry stem from specific industry's characteristics. These characteristics are summed below:

- Fragmentation and subcontracting.
- Procurement method and contract restrictions.
- Financial issues.
- Culture and human attitudinal issues with resistance to change.
- Lack of adequate awareness and education around standardization.

- Lack of top management commitment and support.
- Design and construction dichotomy.
- Lack of customer focused and process based performance measurement systems.
- Conservative industry culture.
- Lack of large-scale and repetition possibilities.
- Design-bid-build contracts.
- Impaired aesthetics and quality.
- Strong focus on lowest bid price.

2. *Which are the different perspectives around the factors that determine whether a process is suitable for standardization or not?*

Four perspectives were extracted from the research analysis.

1. The UPA's engine

   This perspective is named after the job location of the majority of this group. In particular, 7 out of 12 respondents are located in Bunnik, Netherlands, where the UPA standardization program is initiated. As the UPA's objective is to preserve the company's core values, maximize profit, reduce risk and "speak the same language" amongst all OpCos, the respondents' high preference towards the standardization of risk, high significance processes, core values, direct impact on profit and OpCo topic relevance is well explained. Moreover, they distinguished on standardizing processes with high complexity as well as processes that deal with many functions. Regarding their lowest preferences, they believe that knowledge, clients and markets do not work as barriers towards standardization. Last but not least, they believe that processes that require employees to innovate do not hinder standardization, a fact that emphasizes their priorities towards process standardization.

2. Routine oriented coordinators

   The perspective is named after the job focus of the majority of this group as well as their strongest preferences. In particular, 3 out of 5 respondents have *business related* jobs. Their focus appears to be strongest towards the standardization of high repetition, routine, predictability, low input and output variety and low uncertainty. Hence, the perspective was named "routine oriented coordinators", emphasizing their strong preference towards routine and coordination aspects. It is a perspective inclined towards stability; respondents prefer routine, predictability, low variety and high structuredness standardization whereas external risks, function interdependent processes and processes with high team interaction should not be standardized. Last but not least, respondents differentiate between operational, "know-how" knowledge and explicit knowledge, stating that the first type of knowledge cannot be standardized.

3. Non-localized top managers

   The perspective is named after the job focus of the majority of this group as well as their job location diversity. In particular, 5 out of 7 respondents have top manager's job. Moreover, this group of respondents is the most diverse as far as job location is concerned; respondents

work at Ireland, UK, Germany and Netherlands. The strong preference of this group towards the standardization of risk, high cost processes, quality assurance checking, impact on profit and team interaction can be linked to the main focus of top managers; elimination of risk, increase in profit, preservation of quality and preservation of excellent client relations. Furthermore, the fact that they translated "processes that require employees to innovate" as already acquired innovation – knowledge, reveals the different way of thinking with regard to the other groups. Regarding their lowest preference, this group does not regard differences in markets, countries regulations, customers and operational knowledge as barriers to process standardization.

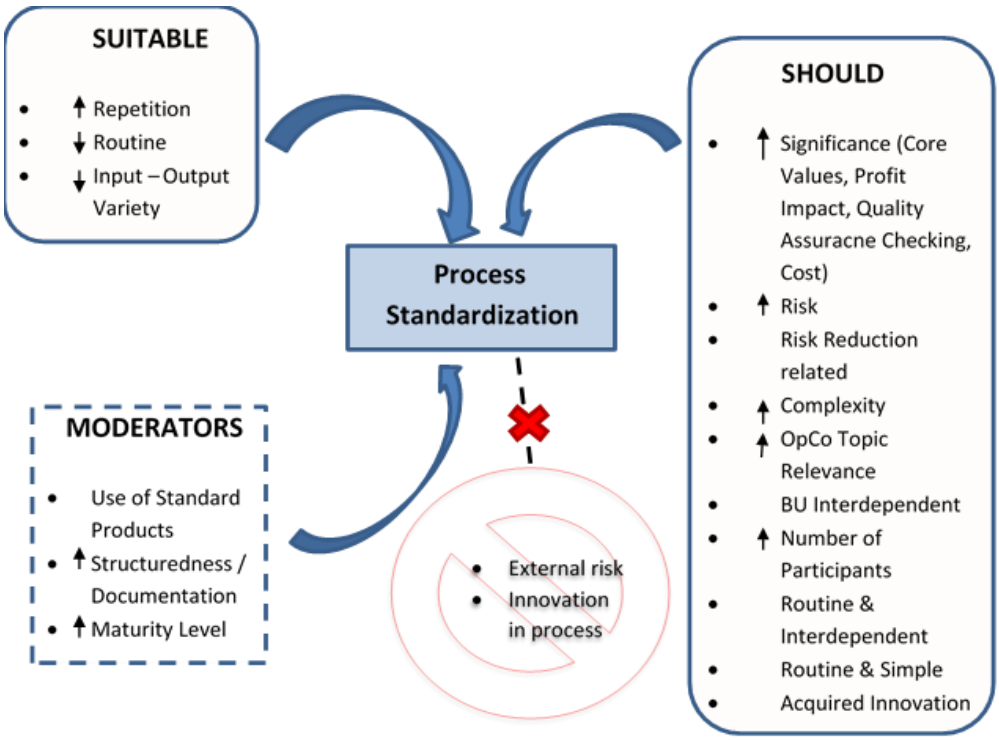
4. Dutch "quality caring" designers

   The perspective is named after the job focus of the majority of this group, their job location as well as the perspective's main focus. In particular, 3 out of 5 respondents are design managers. All respondents are working in the Netherlands. Last but not least, this perspective is the only one that shows such a strong preference towards quality assurance checking standardization (it is on top of the rankings as well as a distinguishing statement). Leaving room for flexibility wherever employees are required to innovate is a strong preference of this perspective as also expected from a design manager. Moreover, standardization of routine and interdependent processes could be explained from the fact that design managers have to deal with many interdependencies so a proper way to handle them is one of their main concerns. Risk standardization is also strongly preferred by this group. Client related processes should not be standardized according to this group. Once again, since design managers are dealing with client requirements, they attribute great importance in that aspect. Finally, they do not believe that markets and different countries' regulations are barriers to process standardization. Also, non-routine and high process variety are not implying that process standardization is not possible.

Main research question:

Which are the determining factors for the decision behind standardizing a process within and across all operating companies of a large multinational construction company?

Combining information from the 4 extracted perspectives, similarities among them as well as the information provided through the questions that participants answered regarding their preferences, a factor model derived. This model proposes the factors that indicate processes that should or should not be standardized, factors that are suitable to be standardized as well as moderators – enablers – of process standardization. The distinction between factors that should be standardized and factors suitable for standardization was based on the way the respective statements were presented in the Q-sort as well as the explanations provided by the respondents.


SUITABLE
Repetition
Routine
Input – Output Variety
SHOULD
Significance (Core Values, Profit Impact, Quality Assuracne Checking, Cost)
Risk
Risk Reduction related
Complexity
OpCo Topic Relevance
BU Interdependent
Number of Participants
Routine & Interdependent
Routine & Simple
Acquired Innovation
Process Standardization
MODERATORS
Use of Standard Products
Structuredness / Documentation
Maturity Level
External risk
Innovation in process

9 Recommendations

This chapter elaborates on the research recommendations. A critical review regarding the implementation of the proposed model by Royal BAM Group is presented in section 9.1. Section 9.2 provides recommendations for future research.

9.1 Recommendations for Royal BAM Group

As discussed in section 7.4, the implementation of the proposed model has some implications for the company. This section provides recommendations on the use and implementation of the proposed model. Recommendations are also provided on how to tackle the barriers of the implementation of process standardization due to the characteristics of the construction industry, as elaborated in sections 3.5 and 3.6.

1. Focus on the human aspect

The most important thing to consider is that no matter how good the technology, it is always people that will ultimately determine whether a new system will work well (Lorenzi & Riley, 2000). As indicated from the Q-analysis, employees of Royal BAM Group share different perspectives on what is more significant when it comes to process standardization. Usually people tend to overlook what others feel as more important for them when this is not in compliance with their own preferences. However, in order for a process standardization transformation to succeed, it is of great importance to focus on a common goal, explore the similarities between the different groups' preferences as well as the reason behind the differences. Each voice has its own weight and should be taken into consideration if aiming in speaking the same language and exploiting lessons learnt to the maximum. This could be aimed by making proper use of relational governance (section 3.3.6) and more specifically of communication, coordination and consensus between the different groups of the company.

2. Gain top management support

Lack of top management support is said to be a barrier towards the implementation of standardization in the construction industry, hence it is something that should be obtained in order to reach standardization goals. However, attention should be paid in 2 related aspects. First, top managers should understand that an organization is run day to day by lower job positioned employees and hence their needs and voices need to be heard and taken into great consideration. As shown in section 5.3, the "top managers' perspective" is profit driven. This should not however make top managers short sighted and miss the point that people are the most important asset a company has. Second, as stated from Björn Münstermann (2010), when a best practice – in this case a proposed model – stems from external of the focal organizational source, employees tend to be reluctant in adopting it, resulting in slower or inefficient implementation. Thus, it is highly recommended that the suggestion of a new model should be done from internal top managers of each OpCo or BU. By that it is implied that first and foremost top managers should inform each other, discuss and decide on a common goal and then each of them inform the lower job layers in their own OpCo and work as ambassadors of this transformation.

3. Invest in organizational learning

Investing in organizational learning (section 3.3.6) is very important as it is the corner stone of the continuous learning and sharing of knowledge. By doing so, the appropriate organizational culture is created and hence implementation of change and superior process performance is facilitated. Moreover, national culture should be taken into account as the transformation aimed for is targeting at a multinational audience.

4. Pay attention to client needs, market differences and type of knowledge

Judging from the main differences between literature review on business process standardization and the research results on process standardization in a construction company, it would be wise to not disregard aspects related to the human factor – clients, markets and knowledge. Although participants of the research pointed out that none of these factors impede process standardization, it is suggested that the right balance is kept by taking into account the needs of clients/markets and the company's benefits, as well as the degree to which tacit knowledge and experience could be of future use by its standardization.

5. Invest in change management

Last but not least, appropriate change management is very important in order for change to be incorporated, accepted and appreciated by the company's employees. The "Kubler-Ross change curve" (Appendix G) suggests 7 stages through which a person passes when encountered with change, which is also valid when talking about business changes. The suggested stages are: shock, denial, frustration, depression, experiment, decision and integration. It is not necessary that a person will encounter each of these steps. However, managers should be prepared to deal with the possibility of their occurrence. Kotter (Kotter et.al., 2012) proposes 8 success factors to implement change: 1) create a sense of urgency, 2) build a guiding coalition, 3) form a strategic vision and initiatives, 4) enlist a volunteer army, 5) enable action by removing barriers, 6) generate short term wins, 7) sustain acceleration and 8) institute change.

To be more precise, in a 1st step it should be made clear why this change is important and needed for the benefit of everyone. In a 2nd step, a coalition of effective people should be created to guide, coordinate and communicate every goal and activity. The 3rd step is the communication of a clear strategic goal by defining what is the vision, what will be different from the past and how it is going to be achieved. The 4th step will be achieved will be achieved by persuading a number of people to become members of this change – movement. Afterall, large scale change can only be achieved when a massive amount of people are supporting and leading it. The 5th step – removing barriers – will enable the work across silos and hence make real impact to the company. Moving to the 6th step, by recognizing and communicating short term wins, the needed motivation to keep going is ensured. The 7th step is making sure that people are not resting forces after the first success. Until the vision becomes reality, efforts should not stop. The 8th and final step is to make sure that the initiated change will be accepted and last in time.

6. Take into account the 4 identified perspectives

As stated in the limitation of the research (section 7.3), due to the low job diversity achieved during the workshops, only 4 different perspectives could be drawn, all of which refer to managerial jobs. It is beyond dispute that the identification of a wider job position range would be more beneficial. However, the 4 identified perspectives should be taken into account in order to accomplish a smoother implementation of the process standardization vision.

The 4 perspectives provide the views of each of the 4 identified groups. Behind these views lie their interests. It is important to grasp the interests behind the underlying views of these parties and understand whether their interests are competing or not. Thereinafter, as mentioned in the 1st step of Kotter's success factors (Kotter et. al., 2012), a sense of urgency should be created for each of the identified groups, by pointing out in what way will their interests be satisfied after this change and hence, commit them after all in the process of change.

9.2 Recommendations for future research

During the execution of the present research it was found that some aspects needed further elaboration. However, due to time constraints, the scope was restricted, rendering these aspects as outsiders of the thesis research. A list of recommendations for future research is presented below:

- Although a model that proposes which factors indicate a process that should or should not be standardized, a process suitable to be standardized as well as moderators of process standardization, the results are not quantitative. It would be more practical to have quantitative data on hand that prove why a factor is listed under should, should not or suitable box.
- Factors related to clients, markets and knowledge are suggested to be taken into account before proceeding to process standardization, until a certain degree. However, time restraints did not leave space for further research on this topic. Moreover, the factor of complexity that is proposed in the model should be broken down to more specific elements in order to be more precise.
- The validation of the proposed model was conducted through expert interviews. It would be more valuable though if it was tested in a demo-process and find out "real life" implementation results.
- The thesis provides recommendations regarding the implementation of the model and process standardization. However, it does not furnish in detail instructions and further research is suggested on how to deal with potential occurring barriers.

10 Reflection

This section adds my personal reflection to this master thesis. First, a reflection on the research methodology and results is provided. In the sequence, an overview of what I would have done differently is given. Last but not least, a general overview of the whole process is described.

Research methodology and results

The main research methodology used for this thesis is Q-methodology. Q-method constitutes an excellent way to identify different viewpoints around a specific subject, in our case, process standardization. However, it is a method that is relying to people's willingness to participate. My personal experience is that it is very hard to convince employees to participate in a research like that. Therefore, it was quite time consuming to gather a sample of 30 people. In addition to that, succeeding in job diversity – the most important diversity factor of this research – was even more difficult. The latter could be attributed to the fact that the company's standardization initiative was mainly known to (top) managers. Therefore, it was difficult to attract employees from operating/engineering jobs. As a consequence, the usability of Q-methodology's results are limited to the 4 identified groups which are all consisting of managers.

Moreover, the factor model has derived from the consensus statements amongst all perspectives. This means that the different groups identified and hence the perspectives themselves are not actually used for the formulation of the model, but are rather used as a recommendation on how to approach these specific groups during the implementation phase.

Last but not least, although flexibility is said to be a very important aspect to be investigated in this research, it is not very clear to what extend flexibility is attributed to a process from the model proposal. In fact it is something that would be more obvious during/after the implementation phase of the findings.

Done differently

Looking back at my research, the weakest part is the identification of perspectives that could be widely used and are not focused only on managerial job positions. Given the limited time scope and keeping in mind how hard it was to attract employees of Royal BAM Group to participate in my research, if I could go back in time, I would have started 1 to 2 months earlier to organize workshops for the Q-sort procedure. That way I could have raised the probability of achieving a more diverse sample of research participants.

Moreover, I would hold personal questions during or after the completion of the Q-sort procedure with the research participants, instead of asking them to fill in the questions themselves. Asking participants to fill in the questions after the completion of the q-sort might be time efficient and easier for them to accept. However, many participants did not respond exactly to the question asked, either because they did not understand it or they wanted to save some time and get it over with. Had I conducted in person questions with them, I could have

better interpreted their preferences on process standardization and probably derive to a more distinguishing perspective.

As far as the context of Q-methodology's statements are concerned, if I would do my research from scratch, I would have paid more attention to two more aspects: IT related factors and the aspect of complexity. As stated from 2 research participants, they missed IT related factors from the statements. Also, as IT is mentioned in the literature findings as a factor that is affecting business process standardization, it should have been added to the research statements. As far as complexity is concerned, I would prefer to be more precise on this aspect by pointing out specific features of a complex process. Last but not least, I would have tried to simplify my statements and not use "non-non" statements, which gave participants the opportunity to be more flexible to what they believe as most important. By placing a non-non statement on the top negative edge, they actually provide another "mostly agree" statement.

Last but not least, If I could run my research once more, I would have asked the participants why they are so strongly determined that market and client related factors are not impeding process standardization. Since it is the biggest contradiction to the literature's findings on business process standardization, I would like to be able to provide an answer to this difference.

Overall opinion

Overall, I believe that process standardization covers a quite wide scope within a research investigation. It is not only factors that are affecting standardization that should be investigated; people, barriers of standardization in the construction industry as well as a proper way to implement/propose a standardization initiative within a construction company are very important aspects of process standardization. Time constraints do not allow a more in depth analysis of this subject and hence the main focus was attributed to the factors and less to the rest of the aforementioned aspects. However, I am more than happy that I have contributed as much as I could to the existing scientific and practical knowledge around this topic. It was a constant marathon towards gathering as much knowledge as possible around this topic which taught me a lot about a new field of interest as well as myself.

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Appendix A – Views on Standardization

Supporting views on standardization	Reference
Improves operational performance	Beimborn et al. (2009), Wuellenweber et al. (2008)
Improves process performance	De Toni Panizzolo (1993), Munstermann et al. (2010)
Facilitates communication	Wuellenweber et al. (2008), Munstermann et al. (2010)
Increases transparency & controllability	Wuellenweber et al. (2008)
Profits from expert knowledge	Phelps (2006), Wuellenweber et al. (2008)
Reduces costs	Mandrodt and Vitasek (2004), Beimborn et al. (2009)
Reduces time	Jayaram and Vickery (1998)
Enhances readiness and ability to react to regulatory changes	Wuellenweber et al. (2008),), Munstermann et al. (2010)
Enhances technical interchangeability	Munstermann et al. (2010)
Improves customer confidence	Beimborn et al. (2009), Wuellenweber et al. (2008), Munstermann et al. (2010)
Allows uniform information systems within companies as information systems support processes	Davenport (2005)

Opposing views on standardization	Reference
Ineffective when faced with unanticipated circumstances	Gilson et al. (2005)
Need for more innovation and improvisation in order to respond efficiently in new growth markets	Gilson et al. (2005), Gibs and Heywood (2012)
Ineffective when dealing with people from different cultures	Gibs and Heywood (2012)
Hinders creativity and innovative activities	Trkamn (2009), Benner and Tushman (2003), Hall and Johnson (2009), Münstermann (2010)
Reduces accountability	Trkamn (2009), Benner and Tushman (2003), Hall and Johnson (2009)
Harms performance	Trkamn (2009), Benner and Tushman (2003), Hall and Johnson (2009)
Innovation and work standardization are mutually complementary	Kondo (2000)

Appendix B – Impact of BPS on organizational performance

Value Dimension	Frequency	Reference
Cost	16	(Ang & Massingham, 2007; Kobayashi, Onoda, & Komoda, 2002; Zhao, 2004) (Münstermann, 2010; Buchta, Eul, & Schulte-Croonenberg, 2010; Hammer & Stanton, 1999; Kumar & Harms, 2004; Manrodt, 2004; McLaren, Head, & Yuan, 2002; Moffat & Archer, 2004; Mortensen & Lemoine, 2008; Münstermann, Eckhardt, & Weitzel, 2010; Perego & Salgaro, 2010; Quintens, Pauwels, & Matthyssens, 2005; Tregear, 2010a; Wüllenweber, Beimborn, Weitzel, & König, 2008)
Efficiency - Performance	10	(Ang & Massingham, 2007; Beimborn et al., 2009; Buchta et al., 2010; Girod & Bellin, 2011; Kumar & Harms, 2004; Mortensen & Lemoine, 2008; Perego & Salgaro, 2010; Rohloff, 2011; Tregear, 2010a; Zhao, 2004)
Quality	6	(Kumar & Harms, 2004; Moffat & Archer, 2004; Münstermann et al., 2010; Perego & Salgaro, 2010; Quintens et al., 2005; Wüllenweber et al., 2008)
Time	10	(Beimborn et al., 2009; Davenport & Short, 1990; Jayaram & Vickery, 1998; Jayaram et al., 2000; Kumar & Harms, 2004; Manrodt, 2004; Moffat & Archer, 2004; Münstermann et al., 2010; Sánchez-Rodríguez, Hemsworth, Martínez-Lorente, & Clavel, 2006; Schäfermeyer et al., 2012)
Global Integration	1	(Girod & Bellin, 2011)
Responsiveness, Enhanced Readiness & Flexibility	5	(Davenport, 2005; Girod & Bellin, 2011; Hall & Johnson, 2009; Hammer & Stanton, 1999; Münstermann & Weitzel, 2008)
Outsourcing success	2	(Davenport, 2005; Wüllenweber et al., 2008)
Customer confidence	4	(Beimborn et al., 2009; Münstermann & Weitzel, 2008; Trkman, 2010; van Wessel, Ribbers, & de Vries, 2006)
Compliance with regulations	3	(Beimborn et al., 2009; Trkman, 2010; van Wessel et al., 2006)
Collaboration	2	(Bandow, Wenzel, & Wischniewski, 2008; Schafermeyer, Grgecic, & Rosenkranz, 2010)
Solve conflicts and ensure consensus	1	(Davenport, 2005)

Technical Interchangeability	3	(Bandow et al., 2008; Davenport, 2005; Trkman, 2010)
Simplified and increased communication, transparency & measurability	6	(Münstermann & Weitzel, 2008; Rosenkranz, Seidel, Mendling, Schaefermeyer, & Recker, 2010; Schafermeyer et al., 2010; Schäfermeyer et al., 2012; Tregear, 2010a; Ungan, 2006)
Increased learning effect	3	(Henderson, 1979; Jayaram & Vickery, 1998; Lapré, Mukherjee, & Van Wassenhove, 2000; Rohloff, 2011)
Increased economies of scale	2	(Sánchez-Rodríguez et al., 2006; van Wessel et al., 2006)
Creativity	1	(Perez-Alvarez & Watad, 2004)

Appendix C - Initial Statements from literature review

Initial Statements from literature review.	
Degree of frequency	
1. Process standardization is successful if the processes are repetitive.	(Seethmaraju, 2009)
2. Process standardization is more beneficial, the higher the transaction frequency.	(Ross, Weill & Robertson, 2006)
3. Non-routine (non-repetitive) processes are not suitable for standardization.	(Schafermeyer et al., 2010)
4. Transactionality and routineness affect the standardization potential of a process.	(Lillrank 2003; M. Schafermeyer et al. (2010)
5. Non-routine processes are less applicable to standardization than routine processes.	(Rosenkranz et al. (2010)
6. Processes with routine transactions across business units with limited value chain activities and significant interdependencies should be standardized.	(Wurm et al., 2018)
Strategic significance of a business process	
7. The higher the significance of a business process, the bigger the benefit of business process standardization	(T. Davenport, 1993)
8. Primary business processes should be standardized in order to ensure that the firm delivers value activities.	(Aki Aapaoja, 2014)
9. Processes that have to do with the company's core activities (core business processes) should be standardized.	(Wurm et al., 2018)
10. Processes that do not have significant impact on coordination do not need to be standardized.	(Wurm et al., 2018)
11. All core value processes should be standardized.	(Wurm et al., 2018)
Degree of process variety	

12. Process standardization is hard to achieve when standardized products are not used.	(Philipp Zelner, 2013)
13. Differences in products and services may require variation in the processes that create, deliver and maintain them (resources constraints).	(Tregear, 2010b)
14. Input and output variety in processes means that standardization would be less successful.	(Aki Aapaoja, 2014)
15. Low degree of input and output variety indicates a process suitable for standardization.	(Romero et al., 2015)
16. Processes with high degree of input and output variety are not suitable for standardization.	(Romero et al., 2015)
17. Organizations with at least a moderate level of process maturity perform better in standardization initiatives.	(Rosenkranz et al., 2010)
Degree of predictability	
18. The more predictable a process, the better it can be standardized.	(Martin & Bell, 2011)
19. A process with a high degree of uncertainty is not beneficial to be standardized.	(Romero et al., 2015)
20. Standardization is not suitable when we have low degree of structure of process activities and process sequence.	(Schafermeyer et al., 2010)
21. The higher the degree of uncertainty, the lower the process standardization success.	(Schafermeyer et al., 2010)
22. High degree of environmental risk leads to higher urgency for process standardization.	(Moffat and Archer 2004)
Degree of complexity	
23. The higher the procedural complexity, the more effort is needed to standardize a process.	(Schafermeyer, Daniel Grgecic, & Christoph Rosenkranz, 2010)

24. Standardization in complex business processes is not beneficial.	(Romero et al., 2015)
25. Complexity is a roadblock for process standardization.	(Schafermeyer et al., 2010)
26. Standardization of complex processes will simplify them and make them more transparent and thus reduce the possibilities of error.	(Rahimi et al., 2016)
Degree of tacit knowledge	
27. The lower the degree of tacit knowledge of a process, the better it can be standardized.	(Schafermeyer et al., 2010)
28. Knowledge work which is said to be impossible to document and model as a standard process.	(Tregear, 2010a)
29. Standardization is hard to achieve when it comes to the jobs of operators and work knowledge.	(Philipp Zelner, 2013)
30. Processes demanding employees with medium to high work experience or tacit knowledge, have less potential to be successfully standardized.	(Schafermeyer, Grgecic et al. 2010)
31. Processes that have to deal with explicit/procedural knowledge are suitable for standardization.	(Romero et al., 2015)
32. Processes that need tacit knowledge to be executed cannot be standardized.	(Romero et al., 2015)
33. Processes that require employees to retrieve, transform and combine knowledge in order to shape innovation are not suited for standardization.	(Schafermeyer et al., 2010)
34. Operational skills and know-how obtained though practical experience are hard to standardize and communicate.	(Lam, 2000)
35. The higher the amount of process participants, the more effort is needed to standardize a process.	(Kien, 2009)
36. The degree of process standardization depends on the degree of commonality	(Romero et al., 2015)

– i.e. the level of similarity between machines or systems that enables interchangeability of parts and components - that can be reached between different process variants.	
37. In a fragmented chain process, flexibility is needed.	(Philipp Zelner, 2013)
38. Frequency of interaction between individuals performing different tasks in different locations.	(Aki Aapaoja, 2014)
39. Standardization is suited for processes with high degree of team interaction, in order to establish common patterns of collaboration and communication within and among work teams.	(Schafermeyer et al., 2010)
40. Processes that are interdependent across business units need to be standardized in order to be better coordinated.	(Wurm et al., 2018)
41. Processes that have to deal with resource interdependencies across and within business units should be standardized as this would lead to increased operational efficiency.	(Wurm et al., 2018)
Market & clients	
42. Standardization is not beneficial in processes where local materials and labor have to be used.	(Koskela, 1992)
43. Differences regarding local market imperatives have their share in process variations	(Romero et al., 2015)
44. Processes related to affected by market imperatives should not be standardized.	(Münstermann, 2014)
45. Standardization cannot overcome the differences in regulations that different locations face (ex: legislations, financial regulations, import/export regulations, employment practices).	(Aki Aapaoja, 2014)
46. There are mandatory and unavoidable variations that stem from differences in regulations such as financial regulations,	(Tregear, 2010a)

	taxation regimes, import/export regulations and employment practices.	
47.	Differences in local market hinder process standardization as it deals with customer expectations, market maturity and local market conditions.	(Tregear, 2010a)
48.	In processes that concern local markets, standardization is possible if local changes are incorporated into the centralized standard.	(Schafermeyer et al., 2010)
49.	Processes that are affected by differences in national financial regulations between different countries – such as reporting standards – are not suitable for standardization.	(Schafermeyer et al., 2010)
50.	Processes or process activities that affect customers the most should be left out of the standardization initiative.	(Wurm et al., 2018)
51.	Processes that focus more on local responsiveness should not be standardized.	(Wurm et al., 2018)
52.	Processes that are characterized by localized legal institutional context and customers' critical requirements that should not be standardized.	(Wurm et al., 2018)
53.	When a process is characterized by operational similarity in the different locations of business units, standardization is suitable.	(Wurm et al., 2018)
54.	Processes that concern financial control of business units and deal with local responsiveness are not suitable for standardization.	(Wurm et al., 2018)

Appendix D - Interview Questions & Statements

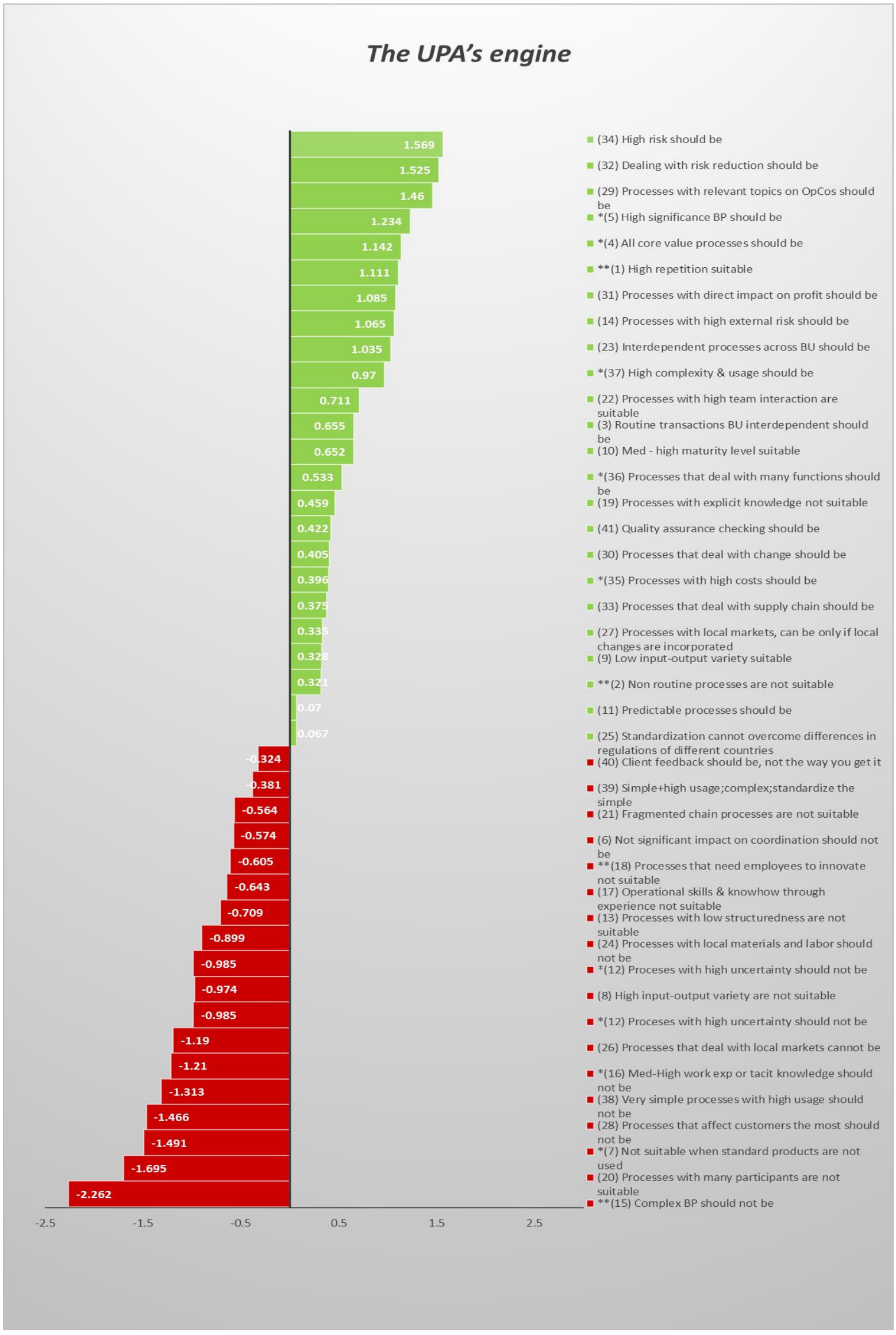
Interview questions
1. What is your background?
2. What is your current job position?
3. What is your experience on standardization?
4. Are you a supporter of process standardization?
5. Do you see any difficulties in BAM's initiative to set a Uniform Process Approach across all OpCos?
6. Which do you think are the characteristic of a process that is suitable to be standardized?
7. Which characteristics define a process that is not suitable for standardization?

Initial statements extracted from interviews
1. Processes that concern relevant topics on every OpCo should be standardized.
2. Processes that deal with change should be standardized.
3. Processes that have an immediate impact on the company's profitability should be standardized.
4. Processes that deal with risk exposure reduction are of high significance and should be standardized.
5. Processes with a mayor impact for the company should be standardized.
6. Processes that deal with local requirements should not be standardized.
7. Processes that deal with local contracts should not be standardized.
8. Processes that deal with local market and clients should not be standardized.
9. Processes that are similar across the different OpCos should be standardized.
10. Processes that are similar across the different OpCos should be standardized.
11. Processes with high complexity should not be standardized
12. Processes that deal with clients' needs should not be standardized.
13. Processes that deal with different customers and different supply chain departments should not be standardized.
14. Processes that deal with the supply chain should be standardized in order to drop price and increase quality.
15. Processes with high risk should be standardized.
16. Processes which are the most costly should be standardized in order to achieve higher efficiency and thus a lower price.
17. Processes with a low impact should not be standardized.
18. Processes with a low frequency should not be standardized.
19. Processes that are cheap should not be standardized.
20. Processes that it does not matter if done differently should not be standardized.
21. Processes with a high impact on the profit of projects should be standardized.
22. The small processes or processes that have no impact on the company's profits should not be standardized.
23. There is a massive amount of international regulation associated with finance, so I would standardize finance.
24. Regional is geographical. Sectors are certain areas with certain customers. So there are requirements that have to comply with customers and by the regulations that they are working on.

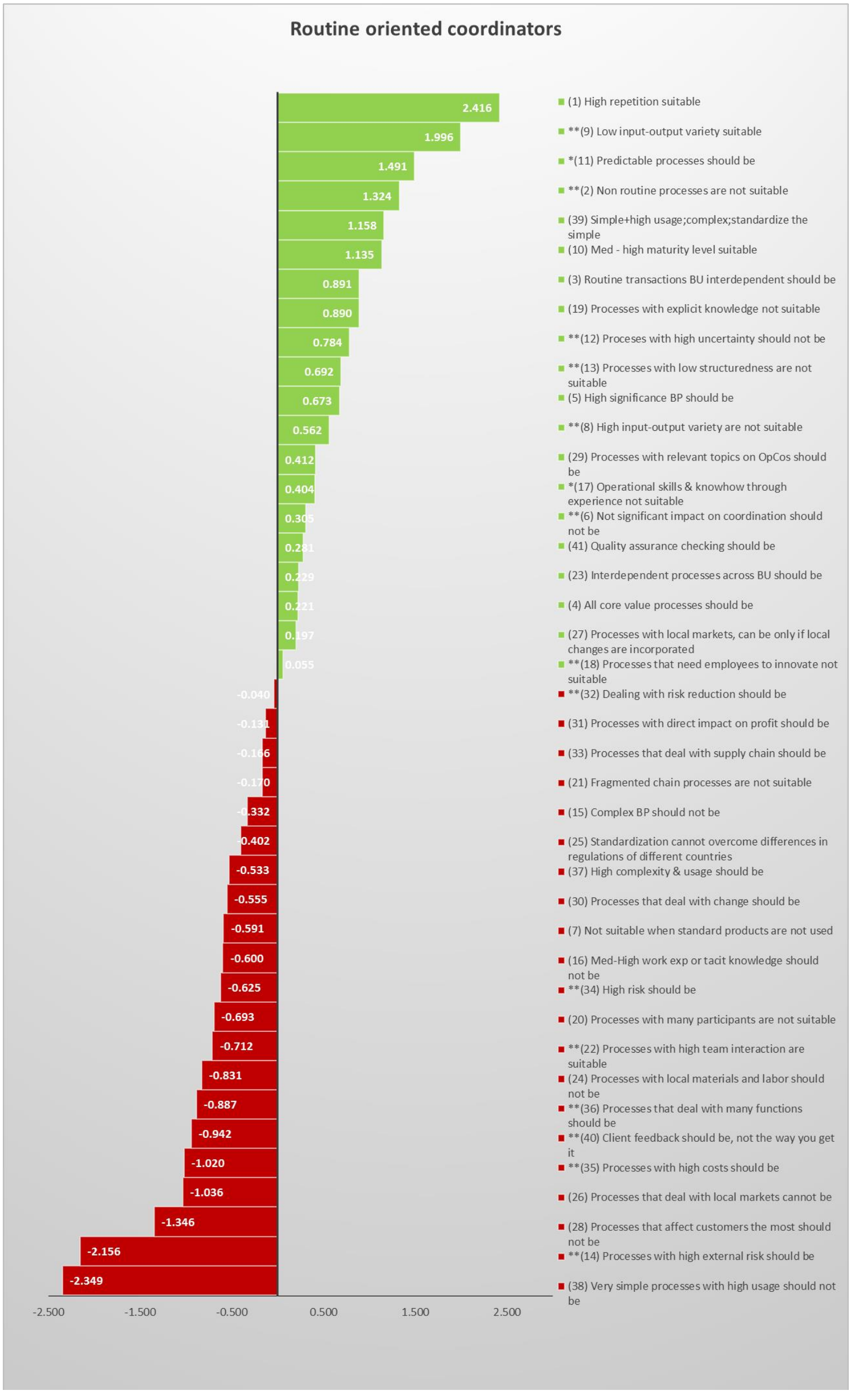
25. I think the processes that span across multiple functions are the ones that benefit the most out of standardization. But still, the devil can be in the detail; there is a lot to pay attention in detail variation.
26. I wouldn't standardize the not so much significant things. I always try to think of coordinates within processes, so you 've got processes that are highly complex and are used a lot. Those are the ones I think you need to have a high degree of standardization. Because if it is highly complex and it is used a lot, you have high risk in it.
27. High complexity and low usage processes should not be standardized.
28. Very simple processes, very high usage. People don't like to be told what to do all the time. So if you go down to the road of completely standardizing rules, then you stifle the low level innovations. It can also cause disengagement of employees.
29. Wherever you have an interface with something that is very simple and very high usage with something that is very complex then you need to look at standardizing that simple process.
30. Processes with low usage and low complexity; I wouldn't standardize them.
31. Knowing people and know that you can trust them and you keep each other "alive". relationship . Knowledge, people (relationships) and processes. Knowledge and technical skills cannot be standardized.
32. Customer satisfaction, I think you should capture your feedback from a client but how you get that feedback should be open. You should leave the technical aspects to people or disciplines they belong to.
33. I think it should be a process with high impact in the project objective.
34. It should be a process which is affected by all the contractual properties or requirements; so processes that are initiated from the business side are probably more suited than processes initiated by the client side.
35. Important process, not too much variety, something with risk or complexity and maybe risk in terms of failure costs.
36. Things you cannot standardize are emotional aspects actually.
37. Standardizing a process that has immediate effect.
38. If you know the risk where all the interconnections are, then you can prevent assets from failures and then you can have improvements on something on more complex, risky assets.
39. Market differences will show up in some point.
40. Repeated processes that are measured should be standardized.
41. Processes that are reused in a regular basis should be standardized.
42. Processes that do not add value shouldn't be standardized
43. Management reporting should be the same everywhere.

Appendix E – Q-analysis Z-scores

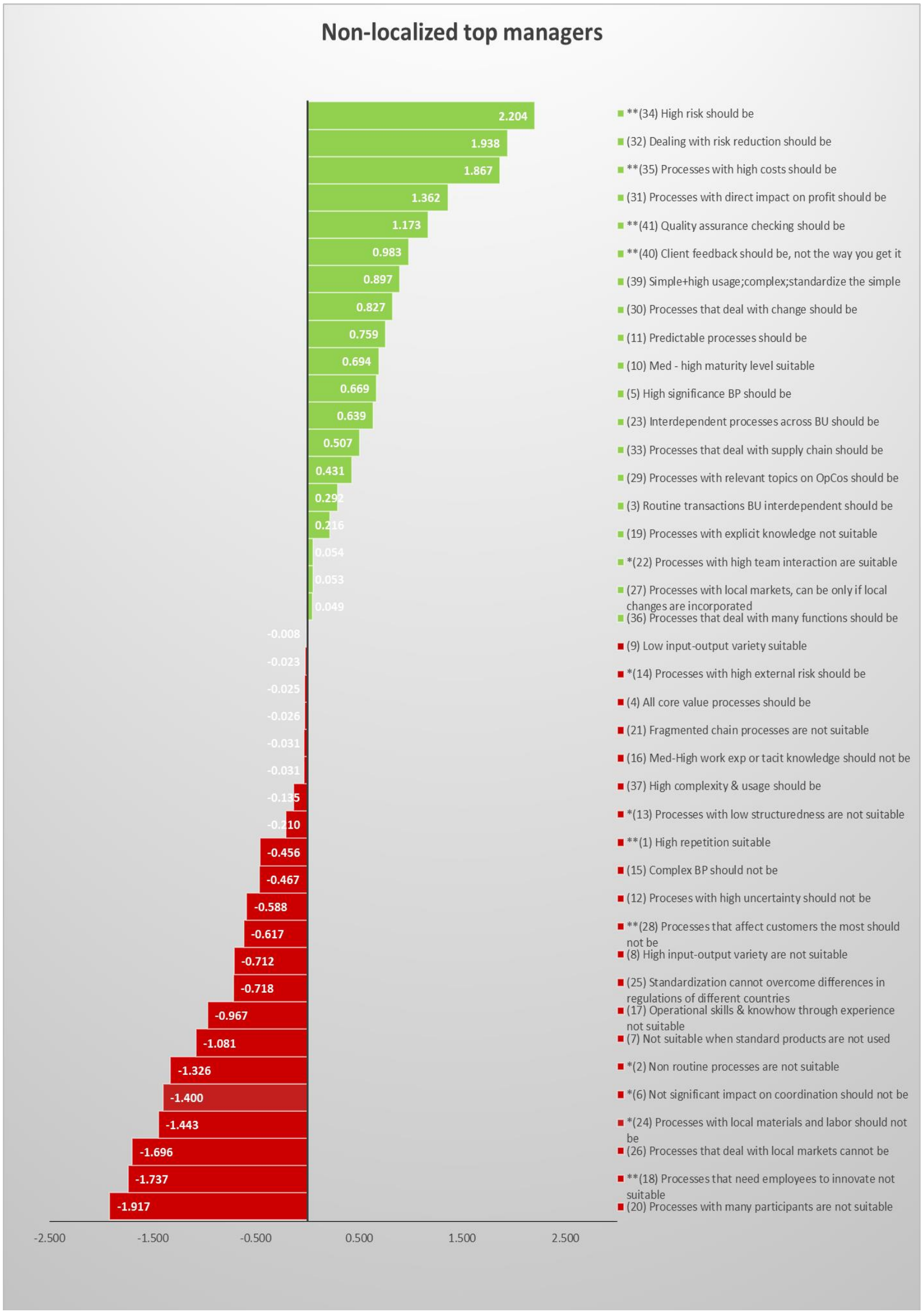
Z scores of the 1st perspective.



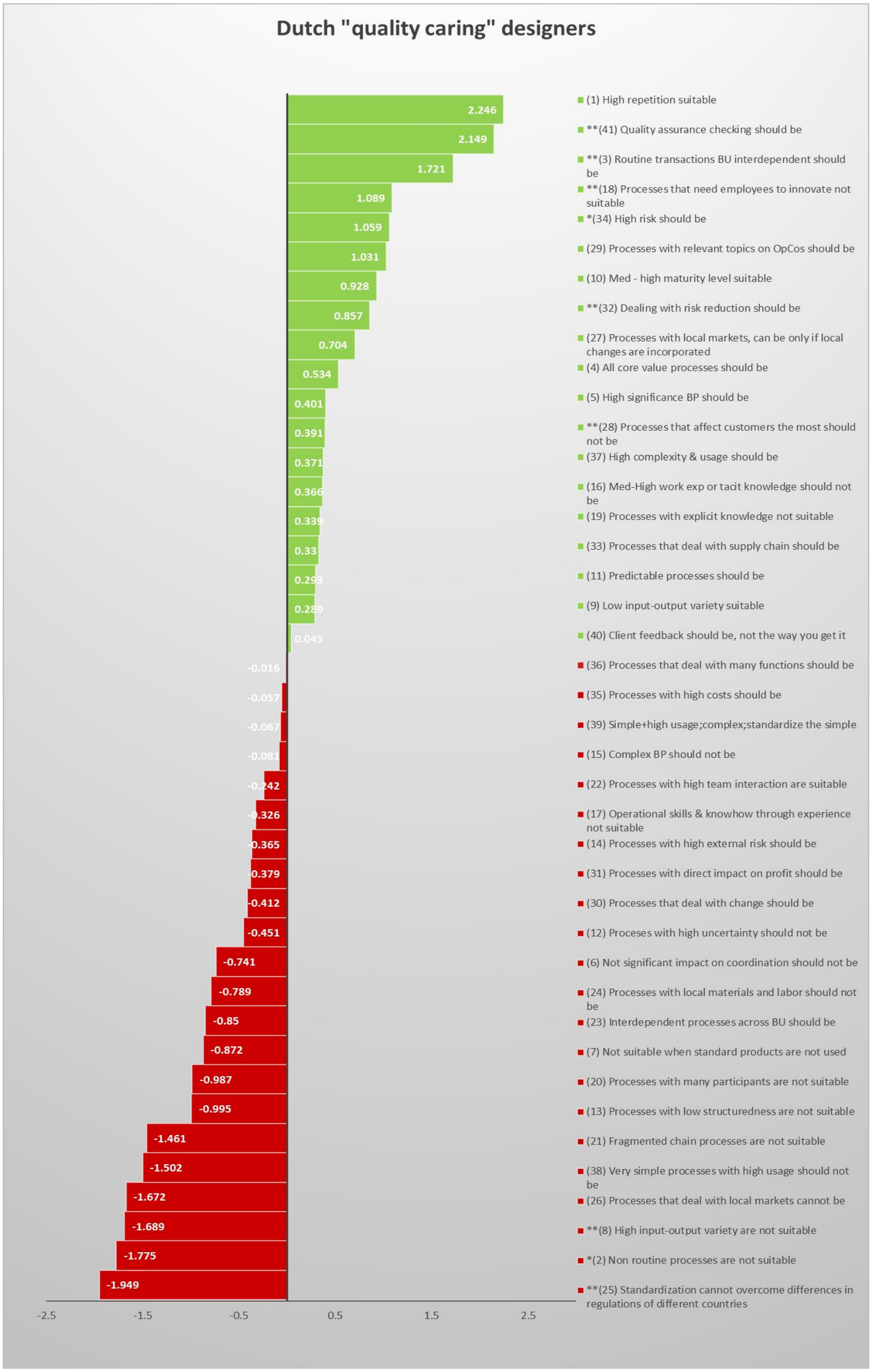
Z scores of the 2nd perspective.



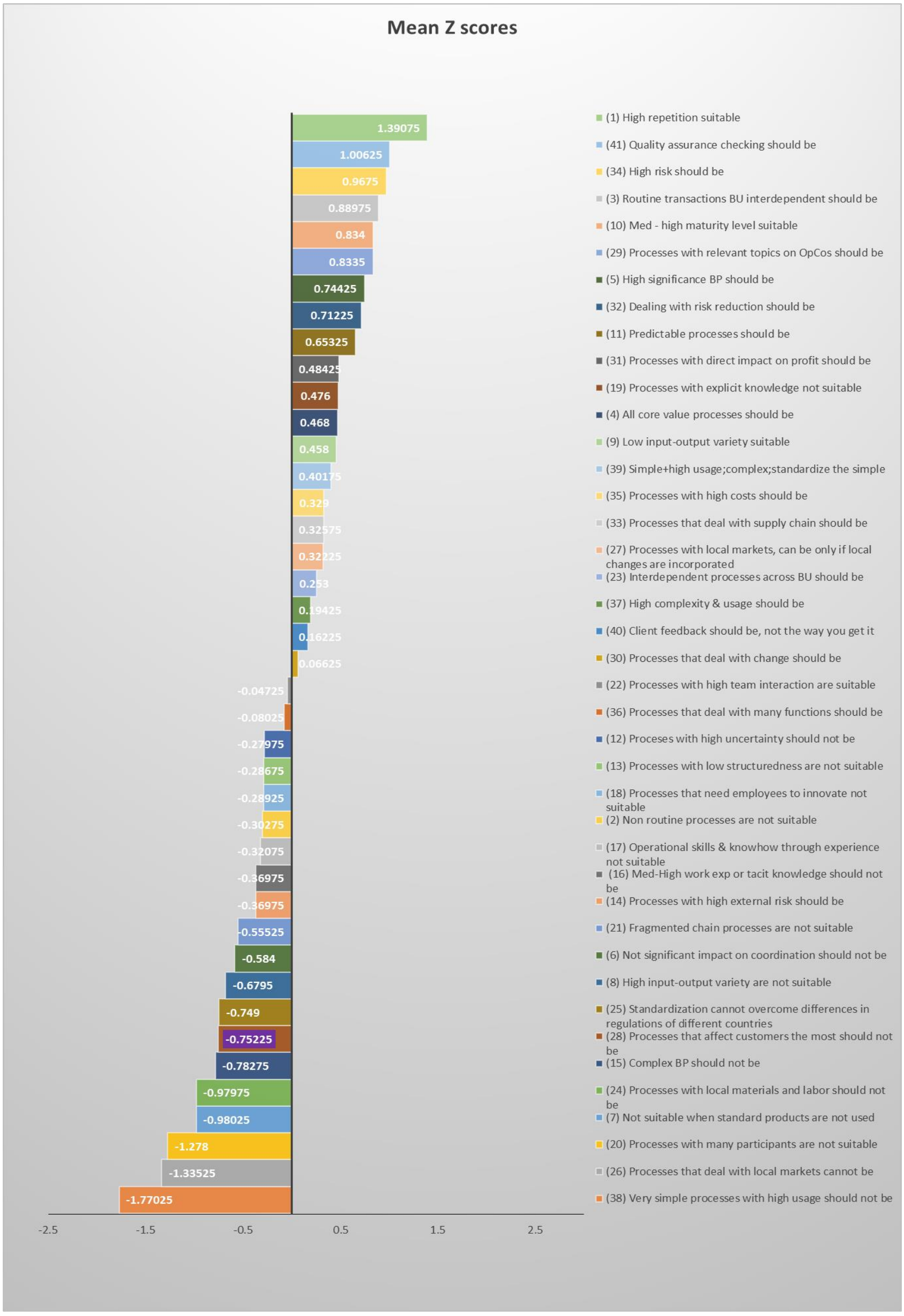
Z scores of the 3rd perspective.



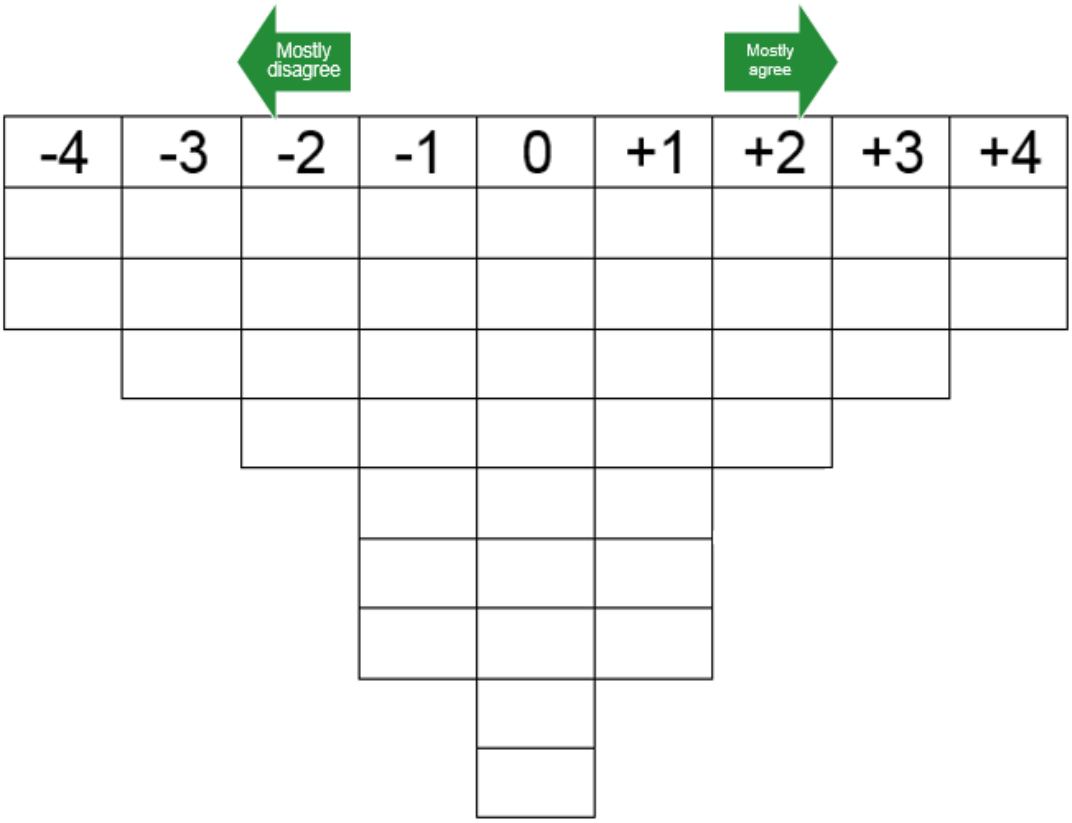
Z scores of the 4th perspective.



Mean z scores of all perspectives.



Appendix F – Factor extraction



Q-grid table for 41 statements as provided in the Q-sort workshops.

The gender, job position, location and years of experience of the workshops' participants are illustrated below.

Perspective	Gender	Job Position	Location	Y Exp
1	Male	Project Manager	Bunnik, NL	10
	Male	Design Manager	Breda, NL	23
	Male	Head Tendering & Engineering	Germany (Frankfurt)	15
	Male	Program Manager	Gouda, NL	13
	Female	Tender Manager	Netherlands	13
	Male	Internal Auditor	Bunnik, NL	15
	Male	Project Manager	Bunnik, NL	5
	Male	BP Improvement Manager	Bunnik, NL	34
	Male	Program Manager	Bunnik, NL	18
	Female	BP Coordinator	Bunnik, NL	3
	Male	QHSE Director	Belgium	25
	Male	IT Development Manager	UK	12
2	Male	Project Manager	Gouda, NL	30
	Male	Project Manager	Gouda, NL	23
	Male	Business Consultant	Bunnik, NL	6
	Male	Head of BP and Quality	UK	33
	Male	Business Management System Leader	UK	15
3	Male	Head of Digital Construction	Ireland	14
	Male	Construction Director	London	23
	Male	Construction Director	Dublin	25
	Male	Management Board	Germany (Frankfurt)	21
	Male	Project Director	Netherlands	25
	Male	Business Architect	Bunnik, NL	25
	Male	Lean Consultant	Germany (Stuttgart)	3
4	Male	Design Manager	Netherlands	13
	Male	Project Director	Netherlands	21
	Male	Design Manager	Gouda, NL	12
	Male	Design Manager	Gouda, NL	18
	Male	KAM- Coordinator	Gouda, NL	11

Factor Matrix with an X Indicating a Defining Sort

	Loadings			
QSORT	1	2	3	4
1 2	0.5775X	0.0702	0.5215	0.2136
2 4	0.5198	0.0786	0.5608X	0.4347
3 5	0.1771	0.1166	0.5158X	0.3417
4 6	0.2097	-0.0626	0.7113X	0.1699
5 7	0.4865	-0.0029	0.5149X	0.2805
6 8	0.2540	-0.1185	0.0726	0.5624X
7 9	0.5351X	0.1025	0.3436	0.1850
8 10	0.5932X	0.1662	0.4888	0.2859
9 11	0.1321	0.1352	-0.0309	0.6256X
10 12	0.6724X	0.0424	0.4339	0.2193
11 13	-0.0034	0.6410X	0.2106	0.4810
12 14	0.1622	0.1285	0.4997X	0.2833
13 15	0.4970X	0.4286	0.2699	0.4084
14 16	0.2245	-0.1732	0.3154	0.4892X
15 17	0.2907	0.3364	0.1931	0.4869X
16 18	0.6630X	-0.0079	0.1134	0.5561
17 19	0.6400X	0.2081	-0.0803	0.0584
18 20	0.0683	0.6950X	0.3050	0.0503
19 21	0.6944X	0.0774	0.5417	0.1045
20 22	0.0003	0.2419	0.2137	0.6564X
21 23	0.4188	0.4224X	0.1646	0.4064
22 24	0.6906X	-0.0202	0.2903	0.4460
23 25	0.1735	0.7777X	-0.1654	-0.1818
24 26	0.5221X	0.3764	0.1003	-0.0553
25 27	0.1338	0.2248	0.6856X	0.0405
26 28	0.5831X	0.0385	0.5235	0.3042
27 29	0.7815X	-0.0475	0.2869	0.1394
28 30	0.7512X	0.1372	-0.0545	0.0524
29 31	0.0161	-0.0586	0.6437X	-0.0839
30 32	0.6092X	-0.1139	0.4428	0.4712
31 1	0.6663X	-0.0048	0.3094	0.4180
32 3	0.0095	0.8580X	-0.0919	0.1520
% expl.Var.	22	10	15	12

Factor Q-Sort Values for Each Statement

No.	Statement	No.	Factor Arrays 1	2	3	4
1	High repetition suit standardization.	1	2	4	-1	4
2	Non routine not suit standardization.	2	0	3	-2	-4
3	Routine transactions bu,limited value chain,interdependencie	3	1	2	1	3
4	All core value should be.	4	3	0	0	1
5	High significance BP should be.	5	3	1	1	1
6	Not sign impact on coordination should not.	6	-1	1	-2	-1
7	Not suitable when standard products not used.	7	-3	-1	-2	-2
8	High input output variety not suit for stand.	8	-2	1	-1	-3
9	Low input output variety suit for stand.	9	0	4	0	0
10	P with Med to high maturity level, suit for stand.	10	1	2	1	2
11	Predictable p should be stand.	11	0	3	2	0
12	P with High uncertainty should not be stand.	12	-2	2	-1	-1
13	P with low structuredness not suitable.	13	-1	1	-1	-2
14	P with high external risk should be.	14	2	-4	0	1
15	Complex BP should not.	15	-4	0	-1	-1
16	Med-High work exp or tacit knowledge should not be.	16	-2	-1	0	0
17	Operational skills & knowhow through exp not suited.	17	-1	1	-2	-1
18	P that need employees innovate not suited.	18	-1	0	-3	3
19	P with explicit knowledge not suitable.	19	1	2	1	1
20	P with many participants are not suitable.	20	-4	-1	-4	-1
21	fragmented chain P, not suitable	21	-1	0	0	-2
22	P with high team interaction is suited for stand.	22	1	-2	0	1
23	Interdependent P across BU should be.	23	2	0	1	0
24	P with local materials and labor,should not be.	24	-1	-2	-3	-2
25	Standardiz cannot overcome dif in regulations of dif countri	25	0	-1	-1	-4
26	P that deal w local markets cannot be stand.	26	-2	-3	-3	-3
27	P w local markets, can be only if local changes incorporated	27	0	0	0	2
28	P that affect customers the most should not be stand.	28	-3	-3	-1	1
29	P w relevant topics on OpCos should be stand.	29	3	1	1	2
30	P that deal w change should be stand.	30	0	-1	2	-1
31	P w direct impact on profit should be stand.	31	2	0	3	-1
32	P that deal w risk reduction should be stand.	32	4	0	4	2
33	P that deal w supply chain should be stand.	33	0	0	1	0
34	P w High risk should be stand.	34	4	-1	4	3
35	P with High costs should be stand.	35	0	-3	3	0
36	P that deal w many functions should be stand.	36	1	-2	0	0
37	P w High complexity + usage should be stand.	37	1	-1	0	1
38	Very simple with High usage should not be stand.	38	-3	-4	-4	-3
39	Simple+high usage;complex;stand the simple.	39	-1	3	2	0
40	Client feedback should be, not the way u get it.	40	0	-2	2	0
41	Quality assurance checking p should be.	41	1	1	3	4

Exact Factor Scores (á la SPSS) in Z-Score and T-Score units

No.	Statement	No.	Factors 1		2		3		4	
1	High repetition suit standardization.	1	0.80	58	2.45	75	-1.09	39	1.95	70
2	Non routine not suit standardization.	2	0.85	59	1.48	65	-1.36	36	-1.99	30
3	Routine transactions bu,limited value chain,interdepen	3	0.61	56	0.61	56	-0.95	40	1.50	65
4	All core value should be.	4	1.37	64	0.12	51	-1.11	39	0.70	57
5	High significance BP should be.	5	1.23	62	-0.03	50	0.04	50	0.73	57
6	Not sign impact on coordination should not.	6	0.02	50	0.44	54	-1.37	36	-0.44	46
7	Not suitable when standard products not used.	7	-1.30	37	0.20	52	0.16	52	-1.31	37
8	High input output variety not suit for stand.	8	-0.23	48	0.48	55	-0.21	48	-2.13	29
9	Low input output variety suit for stand.	9	0.06	51	1.69	67	-0.17	48	0.34	53
10	P with Med to high maturity level, suit for stand.	10	-0.14	49	0.65	57	0.72	57	1.05	61
11	Predictable p should be stand.	11	-1.01	40	1.26	63	1.56	66	0.34	53
12	P with High uncertainty should not be stand.	12	-0.91	41	0.82	58	0.05	50	-0.95	40
13	P with low structuredness not suitable.	13	-0.51	45	0.77	58	-0.05	50	-0.47	45
14	P with high external risk should be.	14	1.48	65	-2.86	21	-0.64	44	0.97	60
15	Complex BP should not.	15	-2.75	23	-0.28	47	0.09	51	0.19	52
16	Med-High work exp or tacit knowledge should not be.	16	-1.87	31	-0.15	49	0.47	55	0.62	56
17	Operational skills & knowhow through exp not suited.	17	-0.58	44	0.19	52	-0.23	48	-0.27	47
18	P that need employees innovate not suited.	18	-0.47	45	-0.13	49	-1.47	35	1.29	63
19	P with explicit knowledge not suitable.	19	0.57	56	0.99	60	-0.23	48	0.00	50
20	P with many participants are not suitable.	20	-1.24	38	-0.65	43	-1.36	36	-0.13	49
21	fragmented chain P, not suitable	21	-0.55	44	0.06	51	0.31	53	-0.90	41
22	P with high team interaction is suited for stand.	22	0.71	57	-0.47	45	0.11	51	0.19	52
23	Interdependent P across BU should be.	23	1.03	60	0.19	52	0.56	56	-0.42	46
24	P with local materials and labor,should not be.	24	-0.23	48	-0.72	43	-1.16	38	-0.48	45
25	Standardiz cannot overcome dif in regulations of dif c	25	1.10	61	0.05	50	-0.27	47	-2.71	23
26	P that deal w local markets cannot be stand.	26	-0.50	45	-0.70	43	-0.98	40	-1.07	39
27	P w local markets, can be only if local changes incorp	27	0.02	50	0.52	55	0.02	50	0.51	55
28	P that affect customers the most should not be stand.	28	-1.63	34	-1.09	39	-0.66	43	0.94	59
29	P w relevant topics on OpCos should be stand.	29	1.55	66	0.33	53	-0.13	49	0.20	52
30	P that deal w change should be stand.	30	-0.19	48	-0.70	43	1.59	66	0.05	50
31	P w direct impact on profit should be stand.	31	1.22	62	0.12	51	1.11	61	-0.89	41
32	P that deal w risk reduction should be stand.	32	0.69	57	-0.30	47	2.09	71	0.49	55
33	P that deal w supply chain should be stand.	33	0.52	55	-0.15	48	0.04	50	-0.05	50
34	P w High risk should be stand.	34	1.12	61	-0.85	42	1.84	68	-0.04	50
35	P with High costs should be stand.	35	-0.02	50	-0.71	43	2.13	71	-0.83	42
36	P that deal w many functions should be stand.	36	0.46	55	-0.87	41	0.29	53	0.25	53
37	P w High complexity + usage should be stand.	37	1.21	62	-0.73	43	-0.13	49	0.43	54
38	Very simple with High usage should not be stand.	38	-0.42	46	-2.44	26	-1.90	31	-0.13	49
39	Simple+high usage;complex;stand the simple.	39	-0.89	41	1.40	64	0.32	53	0.57	56
40	Client feedback should be, not the way u get it.	40	-0.66	43	-1.08	39	1.13	61	-0.02	50
41	Quality assurance checking p should be.	41	-0.53	45	0.09	51	0.85	58	1.92	69

Distinguishing Statements for Factor 1

(P < .05 ; Asterisk (*) Indicates Significance at P < .01)

Both the Factor Q-Sort Value (Q-SV) and the Z-Score (Z-SCR) are Shown.

		Factors							
		1		2		3		4	
No.	Statement	No.	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR
34	P w High risk should be stand.	34	4	1.57	-1	-0.62	4	2.20	3	1.06
5	High significance BP should be.	5	3	1.23	1	0.67	1	0.67	1	0.40
4	All core value should be.	4	3	1.14	0	0.22	0	-0.02	1	0.53
1	High repetition suit standardization.	1	2	1.11*	4	2.42	-1	-0.21	4	2.25
37	P w High complexity + usage should be stand.	37	1	0.97	-1	-0.53	0	-0.03	1	0.37
36	P that deal w many functions should be stand.	36	1	0.53	-2	-0.89	0	0.05	0	-0.02
2	Non routine not suit standardization.	2	0	-0.32*	3	1.32	-2	-1.08	-4	-1.78
18	P that need employees innovate not suited.	18	-1	-0.61*	0	0.06	-3	-1.70	3	1.09
12	P with High uncertainty should not be stand.	12	-2	-0.99	2	0.78	-1	-0.47	-1	-0.45
16	Med-High work exp or tacit knowledge should not be.	16	-2	-1.21	-1	-0.60	0	-0.03	0	-0.08
7	Not suitable when standard products not used.	7	-3	-1.49	-1	-0.59	-2	-0.97	-2	-0.87
15	Complex BP should not.	15	-4	-2.26*	0	-0.33	-1	-0.46	-1	-0.36

Distinguishing Statements for Factor 2

(P < .05 ; Asterisk (*) Indicates Significance at P < .01)

Both the Factor Q-Sort Value (Q-SV) and the Z-Score (Z-SCR) are Shown.

		Factors							
		1		2		3		4	
No.	Statement	No.	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR
9	Low input output variety suit for stand.	9	0	0.33	4	2.00*	0	-0.01	0	0.29
11	Predictable p should be stand.	11	0	0.07	3	1.49	2	0.76	0	0.29
2	Non routine not suit standardization.	2	0	-0.32	3	1.32*	-2	-1.08	-4	-1.78
12	P with High uncertainty should not be stand.	12	-2	-0.99	2	0.78*	-1	-0.47	-1	-0.45
13	P with low structuredness not suitable.	13	-1	-0.71	1	0.69*	-1	-0.14	-2	-0.99
8	High input output variety not suit for stand.	8	-2	-0.97	1	0.56*	-1	-0.62	-3	-1.69
17	Operational skills & knowhow through exp not suited.	17	-1	-0.64	1	0.40	-2	-0.72	-1	-0.33
6	Not sign impact on coordination should not.	6	-1	-0.57	1	0.30*	-2	-1.33	-1	-0.74
18	P that need employees innovate not suited.	18	-1	-0.61	0	0.06*	-3	-1.70	3	1.09
32	P that deal w risk reduction should be stand.	32	4	1.53	0	-0.04*	4	1.94	2	0.86
34	P w High risk should be stand.	34	4	1.57	-1	-0.62*	4	2.20	3	1.06
22	P with high team interaction is suited for stand.	22	1	0.71	-2	-0.71*	0	0.05	1	0.62
36	P that deal w many functions should be stand.	36	1	0.53	-2	-0.89*	0	0.05	0	-0.02
40	Client feedback should be, not the way u get it.	40	0	-0.32	-2	-0.94	2	0.98	0	0.05
35	P with High costs should be stand.	35	0	0.40	-3	-1.02*	3	1.87	0	-0.06
14	P with high external risk should be.	14	2	1.06	-4	-2.16*	0	-0.02	1	0.62

Distinguishing Statements for Factor 3

(P < .05 ; Asterisk (*) Indicates Significance at P < .01)

Both the Factor Q-Sort Value (Q-SV) and the Z-Score (Z-SCR) are Shown.

		Factors							
		1		2		3		4	
No.	Statement	No.	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR
34	P w High risk should be stand.	34	4	1.57	-1	-0.62	4	2.20*	3	1.06
35	P with High costs should be stand.	35	0	0.40	-3	-1.02	3	1.87*	0	-0.06
41	Quality assurance checking p should be.	41	1	0.42	1	0.28	3	1.17*	4	2.15
40	Client feedback should be, not the way u get it.	40	0	-0.32	-2	-0.94	2	0.98*	0	0.05
22	P with high team interaction is suited for stand.	22	1	0.71	-2	-0.71	0	0.05	1	0.62
14	P with high external risk should be.	14	2	1.06	-4	-2.16	0	-0.02	1	0.62
13	P with low structuredness not suitable.	13	-1	-0.71	1	0.69	-1	-0.14	-2	-0.99
1	High repetition suit standardization.	1	2	1.11	4	2.42	-1	-0.21*	4	2.25
28	P that affect customers the most should not be stand.	28	-3	-1.47	-3	-1.35	-1	-0.59*	1	0.39
2	Non routine not suit standardization.	2	0	-0.32	3	1.32	-2	-1.08	-4	-1.78
6	Not sign impact on coordination should not.	6	-1	-0.57	1	0.30	-2	-1.33	-1	-0.74
24	P with local materials and labor,should not be.	24	-1	-0.90	-2	-0.83	-3	-1.40	-2	-0.79
18	P that need employees innovate not suited.	18	-1	-0.61	0	0.06	-3	-1.70*	3	1.09

Distinguishing Statements for Factor 4

(P < .05 ; Asterisk (*) Indicates Significance at P < .01)

Both the Factor Q-Sort Value (Q-SV) and the Z-Score (Z-SCR) are Shown.

			Factors							
			1		2		3		4	
No.	Statement	No.	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR	Q-SV	Z-SCR
41	Quality assurance checking p should be.	41	1	0.42	1	0.28	3	1.17	4	2.15*
3	Routine transactions bu,limited value chain,interdependencie	3	1	0.65	2	0.89	1	0.29	3	1.72*
18	P that need employees innovate not suited.	18	-1	-0.61	0	0.06	-3	-1.70	3	1.09*
34	P w High risk should be stand.	34	4	1.57	-1	-0.62	4	2.20	3	1.06
32	P that deal w risk reduction should be stand.	32	4	1.53	0	-0.04	4	1.94	2	0.86*
28	P that affect customers the most should not be stand.	28	-3	-1.47	-3	-1.35	-1	-0.59	1	0.39*
8	High input output variety not suit for stand.	8	-2	-0.97	1	0.56	-1	-0.62	-3	-1.69*
2	Non routine not suit standardization.	2	0	-0.32	3	1.32	-2	-1.08	-4	-1.78
25	Standardiz cannot overcome dif in regulations of dif countri	25	0	0.07	-1	-0.40	-1	-0.71	-4	-1.95*

Factor Characteristics

	Factors			
	1	2	3	4
No. of Defining Variables	15	5	7	5
Average Rel. Coef.	0.800	0.800	0.800	0.800
Composite Reliability	0.984	0.952	0.966	0.952
S.E. of Factor Z-Scores	0.128	0.218	0.186	0.218

Appendix G – The Kubler – Ross change curve