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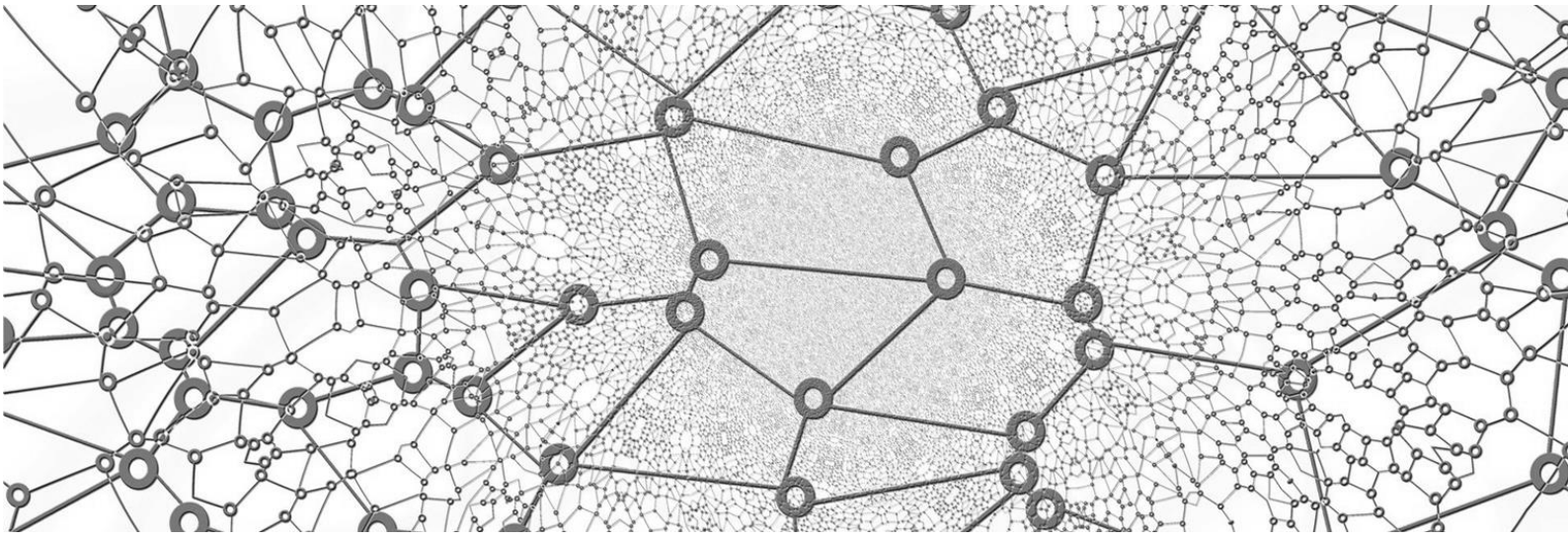
Master Thesis

Designing an app prototype for employee business travel using value-based requirements engineering



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1. Introduction: Knowledge workers have requirements towards a changing, digital workplace

New technologies and applications introduced in our private lives continuously merge into our work life.[1] These technological advances have been on the agenda of managers of knowledge workers for the past decade, raising questions of how to best cope with their implications.[2] A digital workplace, if sought and supported by the organization, provides its employees with different ways of working that can have a positive effect on effectivity, productivity and overall employee engagement.[3] The design of the digital workplace, however, is still a problem for many organizations as finding the optimal balance between organizational agility and organizational control is a challenging task.[4] Additionally, organizations must consider the needs of their employees when digitalizing the workplace. Constant connectivity through digital tools, for example, makes it hard for employees to draw the line between their work and personal life.[5]

In the field of managed travel, the transition to digital tools is accelerating fast.[6] As mentioned before, travelers are adopting travel-related apps and tools from their private lives. As a result, business travelers expect new services to be included in their professional lives as well.[7] Next to that, they are also incorporating emerging trends such as the sharing economy.[8] It has been found that travelers comply with change if it helps them in making their lives easier.[9] Travel managers display a similar level of openness towards change as long as new services are cost-effective and safe.[10] Technological advances and innovations that unfold across various tools and services promise a smarter, faster, and better experience for all stakeholders involved.[11] This requires industry players to incorporate new ways of

[1] See Attaran, M., Attaran, S. & Kirkland (2019)
[2] See Köffer (2015)
[3] See Meister & Willyerd (2010)
[4] See Köffer (2015)
[5] See Kossek (2016)
[6] See CWT (2015)
[7] See CWT (2015)
[8] See CWT (2015)
[9] See CWT (2015)
[10] See CWT (2015)
[11] See CWT (2015)

buying, managing, and experiencing travel.[12] Doing so poses a challenging task for travel managers across all industries.[13]

Company S is a stock-listed corporation with various facilities around the globe and over 137.000 employees worldwide. Their field of expertise lies in the digitalization of energy management and technical automatization. Overall, the company has already implemented a wide variety of digital tools to support a digital workplace for its employees. However, different branches across countries require employees to conduct alternative business processes and activities that frequently reach their limits when it comes to realizing digitalization potentials. In late 2018, Management of one of its branches, hereinafter referred to as SE, initiated the "Young Potentials" program that assigned a group of students to research digitalization potentials for SE. Their findings indicated that the highest digitalization potentials lie in the domains of business travel and networking. An expected result, considering that most of SE's sales activities require business travel with sales managers visiting clients, fairs, or suppliers in order to market their products. Their need for assistance in business travel matters is further strengthened by the fact that they used to have dedicated personal for planning and managing travel activities which is no longer the case. Additionally, SE is currently restructuring its business travel environment by transitioning from a combustion engine to an electric car fleet, which brings new challenges for travel activities. The research goal of this thesis is to further develop the digitalization process of SE in the travel domain by gathering the requirements of SE and its employees towards a digital travel solution.

Research question:

"How can stakeholder requirements and values be incorporated in the prototype design of a digital business travel solution?"

The following paragraphs offer definitions of core variables and concepts mentioned in the research question:

[12] See CWT (2015)
[13] See CWT (2015)

For a system or application to work correctly, a set of functional and non-functional *requirements* needs to be included in software development.[14] In regards of this master thesis, functional requirements are defined as requirements that "(...) specify the inputs (stimuli) to the system and the outputs (responses) from the system, and behavioral relationships between them (…)."[15] Non-functional requirements, defined as: "A requirement on a service that does not have a bearing on its functionality, but describes attributes, constraints, performance considerations, design, quality of service, environmental considerations, failure, and recovery,"[16] are not researched in this thesis.

Stakeholders of SE in the context of the thesis addresses Human Resources and Travel departments of SE on the one hand, and employees of SE on the other hand. For the different methodologies applied in this thesis, the author uses individual employee samples. However, they all share the following characteristics: They are frequent travelers, meaning they have at least one business-related trip every single week. They recognize SE's current travel policy and the associated processes and software tools. Additionally, they reside in Germany, conduct the majority of their business travel within Germany, Switzerland, and Austria, and are associated with one of the four main company facilities in Germany.

The author chooses to develop a *digital solution* based on three circumstances. First, prior research by the 'young potential' program already identified the need for a software-based solution during a workshop with stakeholders of SE. Second, the employee sample of the research share the characteristic of being mobile workers, therefore, requiring mobile IT to serve their needs during business travel. Third, the author of this thesis has working experience in the software product management domain and is capable of combining theoretical research and practical knowledge. Based on the second circumstance, the solution developed in this research requires to work on mobile devices, namely laptops and smartphones.

Business travel in the context of this thesis refers to a business-related task, that requires the employee to travel from point A to point B and return to point A eventually. A business trip

[14] See Chung & do Proda Leite (2009)
[15] Glinz (2007), p. 2
[16] Glinz (2007), p. 2

can vary from a few hours or a few kilometers of travel to a multi-day project that requires the employee to accommodate at the destination. As there are different kinds of business trips, this thesis focuses on the variation that is most used by the employees of SE and involves sales activities on fairs, events and company facilities.

2. Theory

2.1 The digital workplace creates new opportunities for employees and management

The digital workplace and its associated concepts are beneficial to organizations that aim at optimizing knowledge worker productivity.[17] Research even suggests that because of an accelerated, globalized world, organizations are forced to acknowledge and act upon the continuous development of digital work by providing a suitable environment.[18] Practice organizations and consultancies have been addressing the digital workplace as a whole; however, research by scholars focussed on related topics instead.[19] Köffer (2015) conducted a literature review on the academic body of knowledge of the digital workplace intending to provide practical implications for organizations on designing digital tools and applications.[20] Moreover, recent research points out that promoting digital work is not exclusively about introducing new IT but rather about restructuring current work practices with the use of new IT.[21]

The literature review by Köffer (2015) yielded four critical concepts within the field of the digital workplace: collaboration, compliance, mobility, and stress and overload.[22] *Collaboration* describes the use of technology, such as group support systems or social media, to foster interaction between employees.[23] *Compliance* relates to well-meaning, non-compliant behavior that occurs when ignoring IT guidelines or misusing technology at work.[24] *Mobility* is about the management of mobile IT for employees at the workplace as well as empowering mobile workers in their business processes.[25] *Stress and overload* originate from technology overuse at work, leading to information overload, technostress, and work-life conflict.[26] As the research goal of this thesis lies within the digitalization of

[17] See Köffer (2015)
[18] See Köffer (2015)
[19] See Köffer (2015)
[20] See Köffer (2015)
[21] See Dittes, Richter, Richter & Smolnik (2019)
[22] See Köffer (2015)
[23] See Köffer (2015)
[24] See Köffer (2015)
[25] See Köffer (2015)
[26] See Köffer (2015)

business travel processes, the author describes the concept of mobility thoroughly in the next paragraph.

The location of where employees work changed considerably over the past years, with many organizations partially or fully withdrawing from a traditional office space.[27] In parallel, many employees feel that the duration of business trips and time spent commuting is too high.[28] Several studies indicate that these developments can be associated with an increase in mobility of work.[29] As for practical recommendations, Köffer (2015) suggests first to acquire individual requirements of employees depending on their business processes, tasks, and job roles.[30] As a result, organizations achieve a match between the challenges of the job and the type of mobile technology applied as a solution.[31] Based on prior research, mobile work has not reached maturity in organizations.[32] Therefore, Köffer (2015) suggests an open exchange of work practices among departments and employees and to emphasize working together more closely.[33] Support in forms of guidelines and trainings on how to use mobile IT is an example of an open exchange of work practices.[34] Literature also highlights that mobile IT should offer user-liberation, meaning to empower mobile IT use for employees, to grant room for experimentation, and to incentivize mobile IT adoption.[35]

Scholars of recent publications provide additional recommendations for organizations to include in their digital workplace. Dittes et al. (2019) emphasizes the importance of regularly reviewing the use of digital work as well as its impact.[36] Inappropriate use of mobile IT, for example, should lead to adjustments and redesigns of current activities and their underlying digital tools.[37] Building upon the argument of fostering an open exchange, as mentioned by Köffer (2015), a transfer from a command and control leadership style to an open and collaborative organizational culture must develop as well.[38] Consequently, open exchange between departments and employees must be allowed by middle management without them

[27] See Köffer (2015)
[28] See Dittes et al. (2019)
[29] See Köffer (2015)
[30] See Köffer (2015)
[31] See Köffer (2015)
[32] See Köffer (2015)
[33] See Köffer (2015)
[34] See Köffer (2015)
[35] See Köffer (2015)
[36] See Dittes et al. (2019)
[37] See Dittes et al. (2019)
[38] See Dittes et al. (2019)

acting as information filters.[39] Lastly, involving employees in the introduction process of Mobile IT is of high importance.[40] Beneficial effects of early involvement include high employee motivation and early access to valuable user feedback.[41]

While these recommendations are valuable for fostering digital work in organizations, they all display somewhat of a managerial perspective. Technological design of solutions for digital work, however, is almost not discussed in the reviewed literature. For this thesis, parts of the technological design of a digital workplace solution, namely a software prototype to support employees within the business travel process, serves as the final deliverable. In order to provide the theoretical background to work towards that deliverable, it must first be identified what business travel means and what kind of findings recent research yields in the domain of digitalizing the business travel process.

2.2 Business travel requires the use of mobile IT

Today's global economy requires companies to engage in international business activities often through the means of incorporating business travel for their employees.[42] In 2014, business travel covered 14% of the international tourism market.[43] Although we find ourselves in the age of increased IT-usage, it appears that, especially in the corporate environment, face-to-face communication still plays a crucial role.[44] In order to define the term business travel, it must be clarified that authors often use it correspondently with the term business tourism. However, Swarbrooke & Horner (2001) deny their synonymic use and define business travel as: "the movement of business travelers from place 'A' to place 'B'", including business-related day trips of employees.[45] Business tourism, on the other hand, describes broader aspects of business travel and presupposes being away from home for multiple days.[46]

[39] See Dittes et al. (2019)
[40] See Dittes et al. (2019)
[41] See Dittes et al. (2019)
[42] See Unger, Uriely & Fuchs (2016)
[43] See Unger et al. (2016)
[44] See Unger et al. (2016)
[45] Swarbrooke & Horner (2001), p. 3
[46] See Swarbrooke & Horner (2001)

Literature suggests two categories of business travelers and up to four phases of the business trip.[47] The first category occasionally travels to meetings, events, or corporates, while the second category is engaged in recurring business travel with remote target destinations every day.[48] Regarding the four phases of a business trip, 1) trip preparations, 2) passenger experience, 3) destination experience, and 4) homecoming, it was found that they often occur in a cyclical matter as the preparations for the upcoming trip are conducted in the homecoming phase of the current trip.[49] Lenz, Gewald & Coccorullo (2015) distinguish between three phases that have intersections with Unger et al. (2016), "pre-trip" and "on-trip", but add post-processing as a third phase.[50]

2.2.1 Mobile travel applications gain more importance for their users

Scholars agree that today's workforce consists of individuals from four major generations, namely the "Silent Generation", "Baby Boomers", "Generation X" and "Generation Y."[51] Within the workplace, these generations differ in six areas, including their work-value, attitudes, personality, career expectations and experience, as well as their understanding of teamwork and leadership.[52] Many researchers have shown the advantages of mobile technology in travel-related matters. For the user, these are namely its convenience, personalization, immediate access to information, and money savings, as well as its innovative, entertaining and pragmatic character.[53] Scholars have also researched the obstacles of mobile travel technology. For the company, these include high entry and usage costs, data security issues, lack of suitable technology, and the lack of relevant services and features.[54] Although there are obstacles, there is a need for travel applications. It was found recently that 70% of business travelers have travel applications installed on their smartphones and 82% claim to have used at least one of those for their last business trip.[55] Research that focuses on the use of mobile applications in the business travel context, however, is scarce to this date.[56]

[47] See Unger et al. (2016)
[48] See Unger et al. (2016)
[49] See Unger et al. (2016)
[50] See Lenz, Gewald & Coccorullo (2015)
[51] See Douglas, Lubbe & van Rooyen (2018)
[52] See Douglas et al. (2018)
[53] See Douglas et al. (2018)
[54] See Douglas et al. (2018)
[55] See Douglas et al. (2018)
[56] See Douglas et al. (2018)

2.2.2 All-in-one mobile solutions are the most relevant trend for business travel

Most business travelers use their smartphones to serve the purpose of locating destinations, providing navigation assistance, communication with travel agents, as well as reading user reviews, and engaging in social media platforms.[57] Mobile travel applications focus on travel-related tasks that help business travelers throughout their entire travel lifecycle. The CWT Travel Management Institute (2014) present which corporate and other features are most beneficial for users across three distinct phases of the business travel process: pre-travel, during travel, and post travel.[58] These features are illustrated in table 1.

Next to these possible features, the CWT Travel Management Institute (2015) identified the five most critical developments and trends that impact managed travel in the future.[59] Their study consisted of 65 interviews with travel management experts from various fields and an online survey with 1080 travelers and 127 travel managers from international corporates. In the following, these trends will be explained briefly. Figure 1 illustrates all trends and technologies of the study in an impact-maturity matrix.

Mobile technology, as the most critical trend, includes various applications that address a specific topic and provide solutions. However, key developments in this area aim at providing all-in-one "power apps" that can be used across multiple devices. Such power apps also include wearable technologies as well as location-based services, such as enabling users to access a hotel room without a key.[60]

Customization is another rising trend. Through the integration and analysis of Big Data, social media, and other data sources, solutions and services can be built based on the traveler's actions and behavior. Customization has positive impacts on both the travel experience and the services' objectives itself.[61]

Sharing economy brands such as Airbnb and Uber continue to adjust their services to match the demands of the business travel market. As a result, **the sharing economy** becomes

[57] See Douglas et al. (2018)
[58] See CWT (2014)
[59] See CWT (2015)
[60] See CWT (2015)
[61] See CWT (2015)

another viable trend for managed travel that provide travelers alternative solutions for accommodation and ground transport. Also, safety and expense management issues towards those services are decreasing.[62]

New booking solutions emerge based on the needs of travel managers to increase travel efficiency further and reduce travel cost. Such new booking solutions include fare and rate tracking technologies but also proactive tools that help with real-life rebooking during trip interruptions.[63]

In order to simplify processes, compliance, and fraud protection, travel managers have an interest in **new payment solutions** as well. All-in-one payment solutions that focus on one central payment system and can be used with all relevant suppliers are gaining importance in the future.[64]

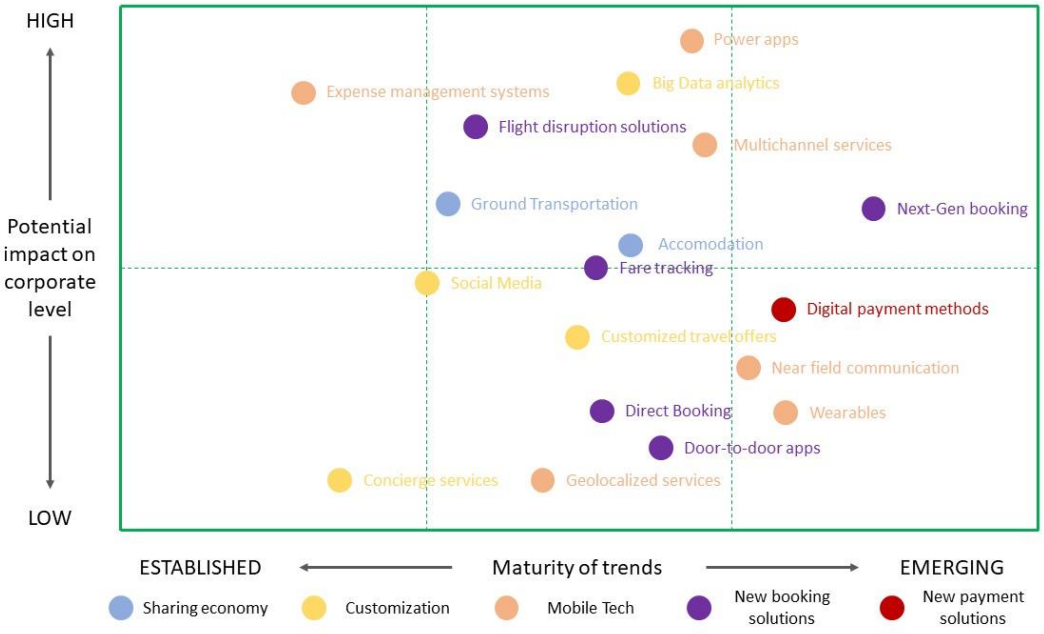

Figure 1: Business Travel Trends

Source: based on CWT Travel Management Institute (2015)

After introducing recent developments and trends in the business travel domain, it becomes clear that there is a business need for such applications to be included in organizations that

[62] See CWT (2015)
[63] See CWT (2015)
[64] See CWT (2015)

deal with business travel. However, the question arises how organizations can implement these trends into their existing business processes. Furthermore, it must be understood how organizations manage business processes in general. This is discussed in the next chapter 2.3.

2.3 Business processes: understanding, managing and modelling processes is critical

Standardized business processes and their development and implementation lies in the focus of organizations.[65] A business process has the potential to form and manage the behavior of both: users and stakeholders, through its regulatory power.[66] Chinosi & Trombetta (2012) define a business process as a set of actions that follow a predetermined order, which ultimately leads to achieving a business goal.[67] Typically, organizations execute these actions within an organizational structure with clear definitions of roles and their interactions with one another.[68] Business processes range from being carried out in a single organizational team to processes that span across multiple organizations.[69]

2.3.1 Business process management involves process design across three subtasks

In order to build and sustain the regulatory power of various business processes, organizations need to manage them systematically through applying business process management.[70] Researchers across the domains of business administration and computer science have been showing interest in the field of business process management for the past years.[71] Beneficial effects of business process management include operational benefits, such as cost savings, increased velocity, higher consistency, and better quality of service.[72] Strategic benefits, such as a higher reaction time to changes in the environment, increase organizational performance.[73] Additionally, business process management inherits the potential of being a driver of innovation, further stressing the need for organizations to

[65] See Reif, Kugler, Brodbeck (2018)
[66] See Reif et al. (2018)
[67] See Chinosi & Trombetta (2012)
[68] See Chinosi & Trombetta (2012)
[69] See Chinosi & Trombetta (2012)
[70] See Reif et al. (2018)
[71] See Mahendrawathi, Hanggara & Astuti (2019)
[72] See Reif et al. (2018)
[73] See Reif et al. (2018)

implement valuable and sustainable business processes.[74] For managers of organizations, Reif et al. (2018) identified four relevant phases of managing business processes: process design, process implementation, process application, and process follow-up.[75] Process design, being the crucial phase for this thesis, is explained in detail in the next paragraph.

Reif et al. (2018) define process design as "the design of new processes or the redesign of existing processes" and suggest to split the design process into three individual subtasks: *process development, process characteristics, and process description*.[76] Especially the process of redesign, also referred to as business process improvement (BPI), is interesting for organizations as it yields beneficial effects with reduced costs and time.[77] Within *process development*, organizations should enable users and stakeholders to actively contribute to the development of the new process or process redesign.[78] Through allowing user participation, managers receive information about processes, that are highly practical and stem from a stakeholder that understands how the process should be in reality.[79] Meeting the needs of users is of utter importance and requires managers to understand their demands and requirements.[80] Moreover, acceptance of and commitment to a given process arises when users recognize that the process provides value within their daily work.[81] Lastly, process development requires managers to include the new process into the existing process environment.[82] The purpose of incorporating the process lies in avoiding process isolation, making it easier for users to have touchpoints with the process, as well as avoiding process duplication, abandoning multiple approaches to work on a given task.[83]

Process characteristics are properties a process should display in order for users to understand, accept, and apply them.[84] The first property, usability, requires a process to be unambiguous and coherent while being written in the language users of the process can understand.[85] As a result, the process is more comfortable to transfer into daily practice and

[74] See Reif et al. (2018)
[75] See Reif et al. (2018)
[76] Reif et al. (2018), p. 1137; as well as see Reif et al. (2018)
[77] See Beerepoot, van de Weerd & Reijers (2019)
[78] See Reif et al. (2018)
[79] See Reif et al. (2018)
[80] See Reif et al. (2018)
[81] See Reif et al. (2018)
[82] See Reif et al. (2018)
[83] See Reif et al. (2018)
[84] See Reif et al. (2018)
[85] See Reif et al. (2018)

offers higher recall value.[86] The second property, goal-orientation, emphasizes the importance for users to be able to identify when and where process decisions are necessary.[87] The process should support users in their decision-making and propose clear instructions for solving problematic situations.[88] Additionally, the process should provide information on how to apply time management and scheduling and include realistic milestones that involve other process stakeholders.[89] By doing so, the process promotes individual decision-making and optimizes time management as well as teamwork.[90] Furthermore, the process should display the property of being binding to all process users.[91] Consequently, every process must have an owner that represents, maintains, and enforces the process towards its stakeholders.[92] Lastly, process standardization and adaptability should be properties of a suitable process.[93] A standardized process is beneficial due to its impact on establishing routines, reducing the effort on process application and documentation.[94] However, too much standardization is counterproductive, which is why a process should have a modular structure that allows process alteration when different stakeholders use it under varied circumstances and in diverse environments.[95]

Process description, as the final step of process design, requires organizations to introduce a process description to the process users.[96] This step should include the description of initiators and deadlines of a process and cover critical issues within the process, such as outlining roles, work steps, inputs, and outcomes.[97] Moreover, organizations need to illustrate dependencies between processes and stakeholders as well as the process's background, functionality, and content.[98] Besides, the process description itself must be usable, accessible to all stakeholders, clearly formulated, structurally organized, visually appealing, and provide additional information, such as example processes, if needed.[99]

[86] See Reif et al. (2018)
[87] See Reif et al. (2018)
[88] See Reif et al. (2018)
[89] See Reif et al. (2018)
[90] See Reif et al. (2018)
[91] See Reif et al. (2018)
[92] See Reif et al. (2018)
[93] See Reif et al. (2018)
[94] See Reif et al. (2018)
[95] See Reif et al. (2018)
[96] See Reif et al. (2018)
[97] See Reif et al. (2018)
[98] See Reif et al. (2018)
[99] See Reif et al. (2018)

2.3.2 Business process modeling offers decision makers different approaches to choose from

"Business Process Modeling is the activity of representing processes of an enterprise, so that the current ("as is") process may be analyzed and improved for the future ("to be")."[100] Large organizations typically inherit a complicated and progressive nature which requires the development of suitable models to better understand their structures and processes.[101] Especially the introduction of new processes or improvements of such, demand a comprehensive understanding of how organizations behave.[102] Depending on the goal a study aims towards, different business process models can be applied in order to provide information elements to its users. However, a satisfactory model should stimulate at least one perspective, whether it is functional (what), behavioral (when and how), organizational (where and by whom) or informational (data).[103]

2.3.3 Business Process Modeling Notation (BPMN)

BPMN is a notation of business processes that translates into a Business Process Diagram (BPD) which makes the business processes understandable for different stakeholders of the organization.[104] A standardized BPMN helps with seamlessly transitioning from business process design to the actual implementation of the process.[105] A basic BPD has four distinct categories that are needed to model a business process:[106]

1. Flow objects[107]
    a) Event: *Start, Intermediate* and *End* of a business process are events that are visualized as circles. These events require either a trigger or a result to be included in the model.
    b) Activity: *Tasks* and *Sub-Processes* within a business process are defined as activities and are represented by a rectangle with rounded corners. Activities can be dependent or independent from other activities.

[100] Chinosi & Trombetta (2012), p. 126
[101] See Giaglis (2001)
[102] See Giaglis (2001)
[103] See Giaglis (2001)
[104] See White (2004)
[105] See White (2004)
[106] See Chinosi & Trombetta (2012)
[107] See White (2004)

c) Gateway: A *Gateway* is used to fork, merge and join paths within the business process. It is represented by a diamond shape.

2. Connecting Objects[108]

a) Sequence Flow: A *Sequence Flow* is used to display the sequence of aforementioned activities in a certain process. It is illustrated as a solid arrow.

b) Message Flow: Being shown as a dashed arrow, the goal of the *Message Flow* is to model the flow of messages between different entities or roles in the process.

c) Association: A dotted line with a line arrowhead represents an *Association* that is handling the association of text, data and other artifacts with the earlier described flow objects.

3. Swimlanes[109]

a) Pool: A participant, whether entity or role, is represented by a *Pool.* It serves as a graphical border to separate activities of different participants. In order to illustrate collaboration or task dependencies between actors in a process, pools are a suitable method of visualization.[110]

b) Lane: The purpose of a *Lane* is the organization of different activities within an individual pool. It is splitting a pool in multiple lanes that illustrate different categories.

4. Artifacts[111]

a) Data Object: Connected to activities by using associations*, Data Objects* aim at clarifying how data is produced or required by activities. It is represented as a sheet-icon.

b) Group: A *Group* is an asset that is not affecting the Sequence Flow but serves documentary and analytic purposes. A dash-lined, rounded corner rectangle is the graphical illustration of a group.

c) Annotation: *Annotations* enable creators of a model to present additional text information to the reader. They are applied as a c-shaped box that connects to a flow object through a dotted line.

[108] See White (2004)
[109] See White (2004)
[110] See Allweyer (2016)
[111] See White (2004)

BPMN has been iterated continuously, adding new elements across the four categories. The latest version is BPMN 2.0 which introduced new characteristics and altered the properties of elements.[112]

2.3.4 Integrated Definition diagrams (IDEF)

Integrated Definition (IDEF) diagrams were first introduced in 1981 and had their origin in Integrated Computer-Aided Manufacturing (ICAM).[113] Meeting the requirements of business process models necessitated two distinct methods of IDEF diagrams to develop: IDEF0 and IDEF3.[114] IDEF0 intends to obtain information about what functions a given system has to offer, but also includes constraints and required in- and outputs.[115] One of the perks of IDEF0 is its simplicity, which is visualized in figure 2. Four arrows represent the notational construct ICOM (Input-Control-Output-Mechanism) that is used to reflect the activities of an organization.[116]

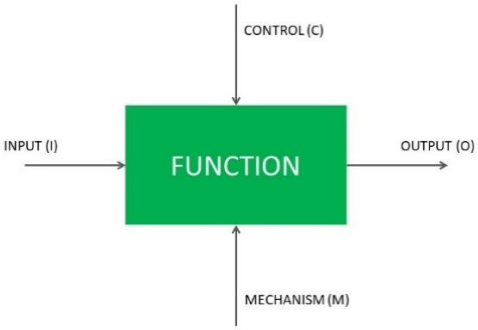

Figure 2: IDEF0: ICOM illustration

Source: based on Bosilj-Vuksic et al. (2001)

IDEF3, on the other hand, used expert knowledge to illustrate how a specific system or organization works.[117] IDEF3 represents processes in a structured sequence that connects several events or activities. It also shows the relation between events and situations by including causalities and preconditions and is often scenario-driven.[118] Similar to IDEF0,

[112] See Chinosi & Trombetta (2012)
[113] See Bosilj-Vuksic, Gialis & Hlupic (2001)
[114] See Bosilj-Vuksic, Gialis & Hlupic (2001)
[115] See Jeong, Wu & Hong (2009)
[116] See Bosilj-Vuksic, Gialis & Hlupic (2001)
[117] See Bosilj-Vuksic, Gialis & Hlupic (2001)
[118] See Bosilj-Vuksic, Gialis & Hlupic (2001)

IDEF3s strength lies in its simplicity. The notational construct, in this case, is called the Unit of Behavior (UOB) and is illustrated in figure 3.[119]

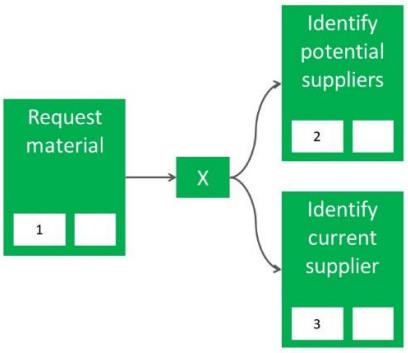

Figure 3: IDEF3: UOB illustration

Source: based on Bosilj-Vuksic et al. (2001)

2.3.5 Petri Nets

Petri nets (PN), introduced by Carl Adam Petri in 1962, are a method for modeling demanding and dynamic systems.[120] As one of the most popular methods of modeling such systems, PN offer characteristics such as simplicity, representational power, synchronization and resource sharing, as well as its ability to perform mathematical analysis.[121] Additionally, PN can be applied for different abstraction levels and have been used successfully in diverse fields of application.[122] Figure 4 shows an example of a simple PN. The circles represent places while the bars indicate transitions.[123] Arrows, also referred to as arcs, connect places and transitions and indicate their direction.[124] PN extensions have been developed over the years to increase their usability in different areas further but will not be addressed in this thesis.[125]

[119] See Bosilj-Vuksic, Gialis & Hlupic (2001)
[120] See Sheng & Prescott (2017)
[121] See Bosilj-Vuksic, Gialis & Hlupic (2001)
[122] See Sheng & Prescott (2017)
[123] See Sheng & Prescott (2017)
[124] See Sheng & Prescott (2017)
[125] See Bosilj-Vuksic, Gialis & Hlupic (2001)

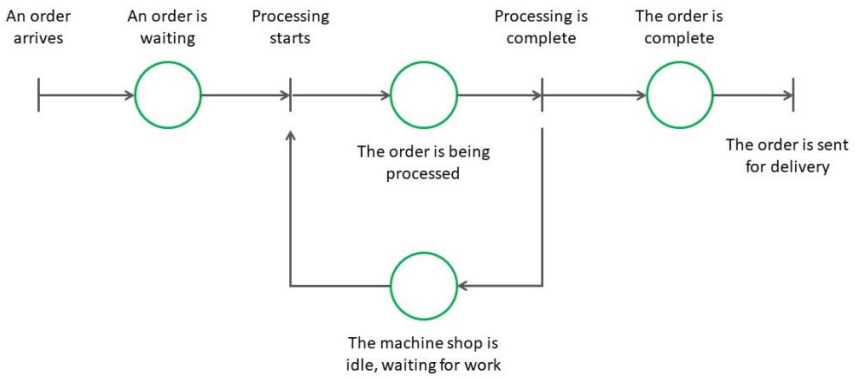

Figure 4: Basic Petri Net

Source: based on Sheng & Prescott (2017)

2.4 Software product management involves all stakeholders

In the previous chapter, this thesis highlighted how organizations should design, characterize, and describe business processes. Given the research goal of designing a software-based prototype for optimizing the business travel process for SE employees, the author is addressing the concept of software and software product management (SPM) in this chapter. The prevailing authority in creating new products or product alterations is software.[126] According to Hull et al. (2017), software achieves this authority based on three trends:[127]

It allows for any system to reach levels of *arbitrary complexity*, enabling organizations to develop complex products.

It allows for *instant distribution*, allowing worldwide and instant distribution of new products or product updates.

It allows to *off-the-shelf components* that empower organizations to get access to technology that they would otherwise need to develop on their own.

SPM is a method that involves internal and external stakeholders to conduct product-related tasks, such as the management of requirements, the definition of the product, and the planning of its releases.[128] Ebert (2014) claims that "no matter what business you're in, you're also in the software business."[129] In the late 90s, software started to become acknowledged

[126] See Hull, Jackson & Dick (2017)
[127] See Hull et al. (2017)
[128] See Vlandeeren, van de Weerd & Brinkkemper (2013)
[129] Ebert (2014), p. 21

as a standard product for various companies.[130] While many known practices of the physical product management apply for software products, there are specific opportunities and challenges that software product management practitioners need to be aware of .[131] One of these opportunities, for instance, is the possibility to distribute multiple products without additional costs for the company.[132] However, organizations should be aware of the fact that managing software products is a demanding task due to its diverse stakeholders, lengthy lists of requirements, and its dynamically changing environment.[133] A product, whether software or physical, must stimulate a need for its users while incorporating the organization's business vision.[134] As a valid measurement or contract mechanism, practitioners should develop and document product requirements that allow for market, business, and technical judgment.[135] In chapter 2.5 and 2.6, this thesis explains how organizations should manage requirements, especially for software products.

2.5 Requirements management: The path from stakeholder requirements to product requirements

"Requirements management entails the activities of gathering, identifying and revisiting incoming requirements and organizing them by keeping in mind mutual dependencies, existing core assets, product lines and themes."[136] Requirements management starts by collecting requirements from internal and external stakeholders and then translating them into product requirements.[137] The next chapter provides in-depth insights on how the optimal process of this translation should unfold in practice.

2.6 The requirements engineering process as the cornerstone of the product design process

This chapter represents the theoretical focus of the underlying master's thesis, as the final deliverable almost exclusively consists of inputs in the form of stakeholder requirements. In their study, Maglyas, Nikula, Smolander & Fricker (2017) identified that requirements

[130] See Van de Weerd, Brinkkemper, Nieuwenhuis, Versendaal & Bijlsma (2006)
[131] See Van de Weerd et al. (2006)
[132] See Van de Weerd et al. (2006)
[133] See Vlandeeren et al. (2013)
[134] See Ebert (2014)
[135] See Ebert (2014)
[136] Van de Weerd et al. (2006), p. 4
[137] See Van de Weerd et al. (2006)

engineering (RE) is one of six core product management activities.[138] RE is a crucial part of the complete system engineering process, as it outlines the problem and serves as the basis for subsequent development procedures.[139] Requirements should define what a system or product must accomplish to satisfy the needs of its stakeholders.[140] Incomplete requirements or a lack of stakeholder involvement are the main reasons for product failure.[141] Generally, the easiest method of displaying requirements for everyone to understand is to express them in natural language.[142] However, doing so poses a challenge as it requires practitioners to refrain from formal or technical jargon.[143] Melegati, Goldman, Kon & Wang (2019) identify three key activities of RE which are elicitation, analysis and negotiation, and documentation and validation.[144] Hull et al. (2017) distinguish two different domains within the overarching concept of system engineering.[145] The *problem domain* is concerned about identifying stakeholder needs, modeling their business processes, and developing stakeholder requirements.[146] The *solution domain* is dedicated to defining system requirements and architectural design.[147] In the following chapters, the focus lies on providing theoretical implications of the problem domain, i.e., the collection of stakeholder requirements.

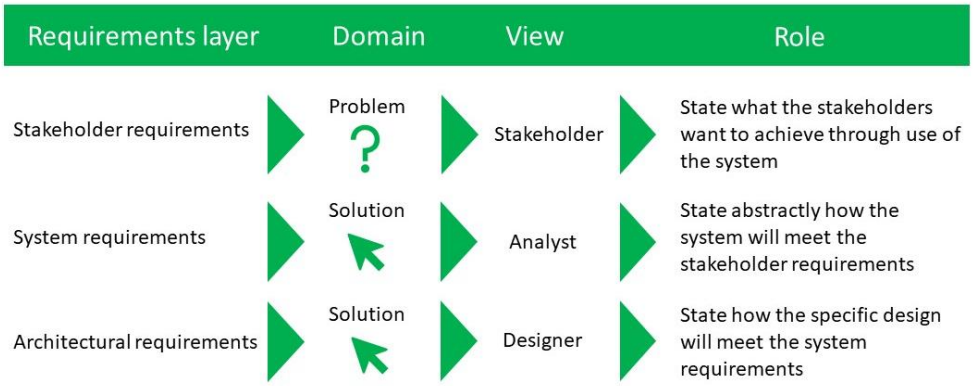

Figure 5: Problem and Solution Domain

Source: based on Hull et al. (2017)

[138] See Maglyas, Nikula, Smolander & Fricker (2017)
[139] See Hull et al. (2017)
[140] See Hull et al. (2017)
[141] See Hull et al. (2017)
[142] See Hull et al. (2017)
[143] See Hull et al. (2017)
[144] See Melegati, Goldman, Kon & Wang (2019)
[145] See Hull et al. (2017)
[146] See Hull et al. (2017)
[147] See Hull et al. (2017)

2.6.1 Requirements engineering in the problem domain is the focus of this thesis

Within the problem domain, it is critical to understand its operational nature when studying requirements.[148] Therefore, requirements engineering in the problem domain should focus on the stakeholder's perspective and allow them to formulate sentences, such as: "I want to be able to (...)."[149] After defining their needs, requirement engineers must model requirements in a fashion that stakeholders can understand and are willing to validate. For this task, practitioners should refrain from using technical models and consider modeling scenarios that are based on practical use cases.[150] After identifying and coping with possible constraints, the process ultimately leads to the creation of stakeholder requirements.[151] In practice, this whole process incorporates several sub-processes that requirement engineers should consider when aiming at a sustainable formulation of stakeholder requirements. The author of this thesis explains these sub-processes in chronological order within the subsequent paragraphs.

2.6.2 Requirements engineering process: statement of need and stakeholder identification

The starting point of the process is the identification of the statement of need.[152] This statement can come in the form of any medium, for example, through an e-mail from senior management, and usually includes the need for a new product, process, or redesign of either.[153] After defining a set of use scenarios and the scope that surround the statement of need with the customer, for example, an organization that commissions a consultancy to do so, the first activity is to identify the involved stakeholders.[154] A stakeholder can be an individual or organization that is affected by the product or has a direct responsibility or opinion about it.[155] For this master's thesis, the author identifies two main stakeholders: *managers* and *system users*. Managers are people with direct involvement in budgeting development and operation of the product.[156] Their involvement yields beneficial effects towards guaranteeing a fit between the proposed solution and the organizational processes

[148] See Hull et al. (2017)
[149] Hull et al. (2017), p. 88
[150] See Hull et al. (2017)
[151] See Hull et al. (2017)
[152] See Hull et al. (2017)
[153] See Hull et al. (2017)
[154] See Hull et al. (2017)
[155] See Hull et al. (2017)
[156] See Hull et al. (2017)

and culture.[157] System users, as one of the most important stakeholder group, directly operate within the environment of where the new product is introduced.[158] Including system users, helps requirement engineers to acquire relevant information from a practical perspective on issues surrounding that environment See Hull et al. (2017). Requirement engineers should also consider how to approach each of the stakeholders, as in some cases, direct access may be hindered, or a representative of a stakeholder group must be selected.[159]

2.6.3 Requirements engineering process: operational scenario establishment

Discussing stakeholder requirements without a mutual understanding of their application domain is unfruitful.[160] Therefore, operational or use scenarios help all stakeholders involved to base their discussions on a common ground.[161] Hull et al. (2017) define a scenario as a: "the *sequence of results* produced (or states achieved) through *time* for the stakeholders."[162] Thinking about their job and its attached processes support users in identifying issues with the current system in place.[163] Including the time dimension yields various benefits for stakeholders, such as identification of overlapping and missing elements within the proposed scenario.[164] Requirement engineers should begin with identifying the final goal of a scenario and then conclude intermediate steps to achieve that goal together with the stakeholders.[165] The purpose of a scenario is to derive capabilities the proposed solution needs to provide and to organize them into a hierarchy while refraining from answering how they will be provided.[166] Hull et al. (2017) point out that there are several ways of modeling operational processes. In chapter 2.2.3, business process modeling, the author of this thesis discusses a possible way of modeling such operational processes. An alternative method, customer journey mapping, is introduced in the methodology chapter.

[157] See Hull et al. (2017)
[158] See Hull et al. (2017)
[159] See Hull et al. (2017)
[160] See Hull et al. (2017)
[161] See Hull et al. (2017)
[162] Hull et al. (2017), p. 92
[163] See Hull et al. (2017)
[164] See Hull et al. (2017)
[165] See Hull et al. (2017)
[166] See Hull et al. (2017)

2.6.4 Requirements engineering process: sources of capturing stakeholder requirements

In the domain of capturing requirements, the following chapter provides information on what methods practitioners can apply to collect stakeholder requirements. Organizations can rely on a variety of sources when it comes to identifying stakeholder requirements. The author of this thesis identifies four distinct sources of requirements, as presented by Hull et al. (2017), that are important for this research. The first source, *requirement workshops* have proven to be a valuable method of gathering and capturing requirements in a short period of time.[167] Stakeholders should be engaged in contributing requirements by making the workshop as accessible as possible and by educating them about the expectations and goals of the workshop in advance.[168] Hull et al. (2017) suggest to present a given scenario which stakeholders should discuss and also criticize interactively. Requirement engineers should rapidly process alterations to the scenario and compose an updated version during the workshop. This new scenario is then presented to stakeholders once more, starting a new iteration of the process that may be repeated multiple times.[169]

The second source, *extracting requirements from informal documents,* describes the process of screening various types of documents, for example, letters, action lists, guidelines, and studies, to uncover hidden requirements.[170] It is crucial to not only unveil the requirements but also to document the origin of these requirements.[171] Lastly, Hull et al. (2017) recommend that practitioners validate requirements collected in that manner by one of the stakeholders.

Third, *stakeholder interviews,* can be used to get access to real-world requirements from human beings. Practitioners should note that the extraction of these requirements is not a technical but somewhat human task and involves speaking about the stakeholder's world in a voice they understand.[172] Hull et al. (2017) recommend to interview stakeholders about steps of their work processes and to refrain from discussing final products or designs.

[167] See Hull et al. (2017)
[168] See Hull et al. (2017)
[169] See Hull et al. (2017)
[170] See Hull et al. (2017)
[171] See Hull et al. (2017)
[172] See Hull et al. (2017)

Additionally, requirements engineers should not be afraid to ask seemingly obvious questions as they often are no experts within the stakeholder's business processes.[173]

Lastly, *requirements from prototypes* allow stakeholders to get a first impression of what solution may be possible.[174] When creating original systems, prototypes can be extremely valuable.[175] The development of prototypes should have the goal of providing a better understanding of previously uncovered stakeholder requirements.[176] Therefore, the design of prototypes should be a sub-project to requirements engineering that has individual stakeholder requirements.[177] The author provides further information on prototypes in chapter 2.8.

2.6.5 Requirements engineering process: writing and structuring stakeholder requirements

After identifying the stakeholder requirements, practitioners may need to (re)write them in a consistent language.[178] As requirements engineering is a process of technical nature, a specific type of writing must be applied to make requirements document both: readable and processable.[179] The typical form of writing a stakeholder requirement is that of a capability description that states a capability required by a specific stakeholder or stakeholder group in a specific environment.[180] According to Hull et al. (2017), such a capability requirement has the following composition:

The <stakeholder type> shall be able to <capability>
with the possible addition of constraints that result in appending
within <performance> of <event>
while <operational condition>.

[173] See Hull et al. (2017)
[174] See Hull et al. (2017)
[175] See Hull et al. (2017)
[176] See Hull et al. (2017)
[177] See Hull et al. (2017)
[178] See Hull et al. (2017)
[179] See Hull et al. (2017)
[180] See Hull et al. (2017)

Within the context of this thesis, a suitable example would translate to:
The *employee* shall be able to find work colleges
within *5 kilometers* of *the project location*
while *on a business trip*.

The use of "shall" specifies that the text excerpt represents a requirement.[181] Additionally, including "should" and "may" allows the association of varying priorities within requirement documents.[182] Direct language and the use of established and acknowledged terminology is vital for writing requirements.[183] Additionally, practitioners should write one requirement at a time and guarantee its testability.[184] Aside from the wording, requirement engineers should meet the criteria, presented in table 2.

From a business perspective, it is valuable to organize the complete set of requirements into a thought-out, structured document for review and management purposes.[185] Typically, such documents are hierarchical, allowing for classification of requirements based on their position in the document. When models, such as stakeholder scenarios are available, requirement engineers can derive a heading structure for the requirements document based on hierarchical steps within the scenario.[186] Also, attributes may be used to describe requirements further and provide additional background information.[187] Including attributes enables additional document management possibilities, such as filtering, sorting, and controlling.[188] The central concept of structuring requirements documents lies in the formulation of individual use scenarios.[189] Hull et al. (2017) advise requirements engineers to combine individual use scenarios to create one single main scenario, providing an overview of the entire system and uncovering possible issues with it.[190] If combining scenarios is not possible, the structure of the stakeholder requirements document should

[181] See Hull et al. (2017)
[182] See Hull et al. (2017)
[183] See Hull et al. (2017)
[184] See Hull et al. (2017)
[185] See Hull et al. (2017)
[186] See Hull et al. (2017)
[187] See Hull et al. (2017)
[188] See Hull et al. (2017)
[189] See Hull et al. (2017)
[190] See Hull et al. (2017)

adapt to the chronological order in which individual scenarios are experienced by the stakeholders.[191]

2.6.6 Creativity in the requirements engineering process

The previous chapters present a sequence of processes based on the works of Hull et al. (2017) that practitioners can use to establish the requirements engineering process in the problem domain successfully. The author of this thesis uses these processes to guide his research in the methodology chapter. However, it must be said that there are a variety of alternative requirements engineering practices that can function as substitutes or additions to the above-mentioned processes. Aldave, Vara, Granada & Marcos (2019), for example, reference crowd requirements engineering, where users review all requirements and send them to other users for review while providing additional requirements. Other alternatives include requirements engineering using agile methods, as well as including special requirement elicitation techniques.[192] Recently, research introduced the methodology of value-based requirements engineering (VBRE), which is introduced in the following chapter, as it finds application in this thesis.

2.7 Value-based requirements engineering (VBRE)

Practitioners continuously recognize that new systems must be compatible with stakeholders' beliefs and values to be adopted successfully.[193] The presence of studies focusing on stakeholders' emotions during requirements engineering is scarce, although negative stakeholder emotions can be associated with low system acceptance and use after introduction.[194] While value has often been measured in terms of monetary dimensions in many studies, other values such as politics, conflicts between stakeholders, fear of process automation, and culture exist in every organization and must be considered as well.[195] As awareness of these problems is critical, Thew & Sutcliffe (2018) suggest to include values, motivations, and emotions (VMEs) into the requirements engineering process. Values and motivations serve as inputs to the specification of requirements, and emotions should be treated as means for analysis purposes.[196] Doing so can maximize the value of a given

[191] See Hull et al. (2017)
[192] See Aldave et al. (2019)
[193] See Thew & Sutcliffe (2018)
[194] See Thew & Sutcliffe (2018)
[195] See Thew & Sutcliffe (2018)
[196] See Thew & Sutcliffe (2018)

software release or iteration.[197] Gaining insight into the values, motivations, and emotions of stakeholders is a challenging task, as they usually do not disclose such personal information directly.[198] Table 3 shows different values, motivations and emotions and provides their description and implication for practitioners.

2.7.1 Stakeholder values consist of beliefs and attitudes towards externalities

The concept of value ranges from ambition and worth to judgment of valuables of life.[199] Psychology defines values as: "beliefs and attitudes held by people about other people, organisations or artefacts (...)."[200] Additionally, values can yield potential benefits of their application, including economic, social, political, moral, religious, or aesthetic values.[201] When discussing stakeholder values, it is essential to understand that values desire are tacit knowledge, meaning they are difficult for the stakeholder to articulate but can be identified as such when confronted with.[202] As a result, practitioners should compose questionnaires around existing knowledge of the stakeholders, including topics surrounding their background, perception of groups involved, job satisfaction, and personal values.[203]

The process of the VBRE method can be separated into different modes; expert and novice. For the purpose of this thesis, the novice mode will be explained briefly. In a first step, the project circumstances are analysed by the researcher, which leads to a first draft of VMEs of the stakeholders'.[204] These initial VMEs must then be challenged or supported by finding evidence through interviews or other methods, refining the understanding of the actual VMEs. In a final step, these VMEs are then referred to a table of scientifically researched VMEs which leads to the formulation of functional and non-functional requirements.[205]

2.7.2 Stakeholder motivations translate to personal goals

Motivations have their roots in an individual's personality and translate to high-level, persistent personal goals.[206] For practitioners, it is critical to be aware of such motivations

[197] See Thew & Sutcliffe (2018)
[198] See Thew & Sutcliffe (2018)
[199] See Thew & Sutcliffe (2018)
[200] Thew & Sutcliffe (2018), p. 446
[201] See Thew & Sutcliffe (2018)
[202] See Thew & Sutcliffe (2018)
[203] See Thew & Sutcliffe (2018)
[204] See Thew & Sutcliffe (2018)
[205] See Thew & Sutcliffe (2018)
[206] See Thew & Sutcliffe (2018)

as they can contribute towards the understanding of stakeholder requirements.[207] Motivations are especially useful for identification of potential stakeholder conflicts that can help decision-makers to define a mutual set of values when negotiating.[208] In most organizations, values and motivations of the individual stakeholder are positive; however, they can be adverse if external parties like colleagues, the environment, or specific features are involved. These negative associations can point out issues within the design that need to be addressed.[209]

2.7.3 Stakeholder emotions are reactive responses to externalities

Contrary to values and motivations, emotions define as: "reactive responses to events, objects and artifacts."[210] Such an emotional effect can be the result of introducing a new software tool that changes present business processes or ways of working.[211] Researchers found that stakeholders often do not disclose emotions directly. Instead, they can be retrieved by enabling storytelling and from analyzing speech patterns.[212] One possibility of enabling storytelling is to ask stakeholders about their experiences and feelings during a given scenario.[213]

2.7.4 Two methods of VBRE: expert and novice

The process of VBRE allows for two different modes.[214] In expert mode, the classification of values, motivations, and emotions is conducted via training courses and through experience.[215] After classifying the VMEs, requirements engineers can formulate appropriate questionnaires and construct scenarios, storyboards, and prototypes that incorporate the internalized taxonomy.[216] Iterations are also part of the expert mode, indicating that the time resources needed for this mode are more significant than for the novice mode.[217] In novice mode, the project circumstances are analyzed by the researcher, which leads to a first draft of VMEs of the stakeholders'.[218] These initial VMEs must then

[207] See Thew & Sutcliffe (2018)
[208] See Thew & Sutcliffe (2018)
[209] See Thew & Sutcliffe (2018)
[210] Thew & Sutcliffe (2018), p. 445
[211] See Thew & Sutcliffe (2018)
[212] See Thew & Sutcliffe (2018)
[213] See Thew & Sutcliffe (2018)
[214] See Thew & Sutcliffe (2018)
[215] See Thew & Sutcliffe (2018)
[216] See Thew & Sutcliffe (2018)
[217] See Thew & Sutcliffe (2018)
[218] See Thew & Sutcliffe (2018)

be challenged or supported by finding evidence through interviews or other methods, refining the understanding of the actual VMEs.[219] After annotation of the results, requirements engineers need to identify relevant VME categories and their dependencies, causations, and contrast between different stakeholders and, if possible, relate them to already existing functional and non-functional requirements.[220] Figure 6 illustrates the novice mode.

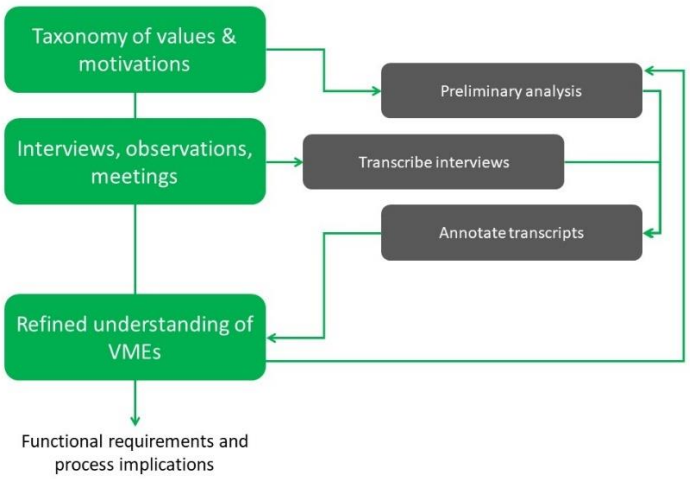

Figure 6: VBRE novice mode

Source: based on Thew & Sutcliffe (2018)

2.8 Prototype design: creating a solution based on stakeholder requirements

At the end of the theory chapter, the author of this thesis presents a few options that practitioners have in order to design prototypes based on the requirements elicited using concepts and methods from the previous chapters. In order to visualize and communicate ideas to a group of stakeholders, a prototype is a suitable tool.[221] There are multiple variations of how a prototype can be developed with different levels of advancement. A mutual characteristic that all of these variations share is the ability to produce feedback.[222]

[219] See Thew & Sutcliffe (2018)
[220] See Thew & Sutcliffe (2018)
[221] See Berger (2011)
[222] See Berger (2011)

According to Hull et al. (2017), prototyping has three essential issues: 1) the prototype is providing too much detail, causing too much time spent developing it, 2) the prototype is pushed towards implementation too early, 3) the prototype is too impressive and stakeholders want to use it operationally.[223] When properly managing stakeholder requirements, the first two issues should not occur. The third issue can be countered through assuring the imaginary nature of a prototype, for example, by focusing on individual use cases instead of a complete product.[224] The following chapter provides an overview of existing prototype categories. The concept of a use case and its importance for prototyping is explained in the subsequent chapter.

2.8.1 Prototype categories range from simple to complex solutions

Literature defines a variety of prototype categories that can be used to visualize ideas and concepts for stakeholders to receive feedback. Berger (2011) points out that the wording "prototype" can be misleading as it does not have to be technical in order to produce feedback. The following categories are listed by complexity, beginning with the most accessible category.

A Conceptual Model is the most basic form of prototype, as it tries to describe the ideas of the users in a conceptual workflow without the need to be technically feasible or realistic (Berger, 2011). Creators of such prototypes often need to explain their approach as it not visualized in any way.[225]

The Low-Fi Prototype already introduced a basic workflow that tries to include operational processes.[226] However, functionality and technical feasibility are still not provided.[227] Users and designers are involved in creating this prototype.[228] Typically, this category already offers paper-based visualization, which helps users with understanding the prototype better.[229]

[223] See Hull et al. (2017)
[224] See Hull et al. (2017)
[225] See Berger (2011)
[226] See Berger (2011)
[227] See Berger (2011)
[228] See Berger (2011)
[229] See Berger (2011)

The next category, Mock-Up, is exclusively created by the designer and often advances the prototype to a digital medium.[230] The Mock-Up should be visually unappealing to avoid the problem of users committing too early.[231] While functionality is still absent, the workflow closely resembles the actual operational processes.[232]
A Dummy, also Click Dummy, represents the next iteration of prototypes. It is still created by the designer and lacks technical feasibility.[233] However, the Click Dummy offers a refined visual design and represents the operational workflow accurately.[234] In order to visualize the prototype digitally, practitioners often use browser-based solutions that can be used on any system or device.[235]

Next, the High-Fi Prototype incorporates software developers and designers into the prototype design process. As a result, the digital High-Fi Prototype distinguishes itself from the Click Dummy through the ability to provide most of the proposed functionality across operational workflows.[236] Additionally, the way of how the prototype is used resembles the modality of the final product.[237]

The software developers exclusively generate the Alpha Grade Version that includes most of the proposed functions but lacks a refined visual design.[238] The goal of this prototype is to demonstrate and test the basic functions that should be included in the final product.[239]

The most advanced prototype category, Beta Version, provides a polished solution, including functionality, feasibility, and visual design that works in the same way as the final product.[240] Additionally, the workflow is fully operational.[241] In practice, Beta Versions are used to test prototypes for bugs and other issues and help solving them.[242]

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[230] See Berger (2011)
[231] See Berger (2011)
[232] See Berger (2011)
[233] See Berger (2011)
[234] See Berger (2011)
[235] See Berger (2011)
[236] See Berger (2011)
[237] See Berger (2011)
[238] See Berger (2011)
[239] See Berger (2011)
[240] See Berger (2011)
[241] See Berger (2011)
[242] See Berger (2011)

2.8.2 Use case development is best conducted via natural language

In order to translate the requirement specification from the VBRE process to viable prototypes, use cases are formulated. A use case is defined as "a goal-oriented set of interactions between external actors and the system under consideration."[243] Researchers claim that the most suitable way of representing the behavior of a use case is to include natural language.[244] They argue that natural language allows all kinds of stakeholders to understand the use case.[245] However, there is no alignment on a specific textual description for a use case, resulting in the emergence of various templates and meta-models.[246] Textual refinement of a use case can be achieved using the use case template that is described in table 4.[247]

[243] Malan & Bredemeyer (2001), p. 1
[244] See Siqueira (2018)
[245] See Siqueira (2018)
[246] See Siqueira (2018)
[247] See Alrawashed, Almomani, Althunibat & Tamimi (2019)

3. Methodology

This master thesis aims at identifying requirements of employees towards a digital network and travel solution. The author decided to use the design science research (DSR) methodology as it originates from the ambition to improve a given environment by introducing innovative artifacts and the process of building them.[248] Hevner (2007) separates DSR in three cycles, as seen in figure 7. In addition to that, Peffers, Tuunanen, Rothenberger & Chatterjee (2007) formulated a structured process of how to apply the DSR methodology, as illustrated in figure 8.[249] Together, these insights build the methodological framework of this master thesis. In the following, the author describes the research design along the DSR methodology by formulating four subordinate research questions.

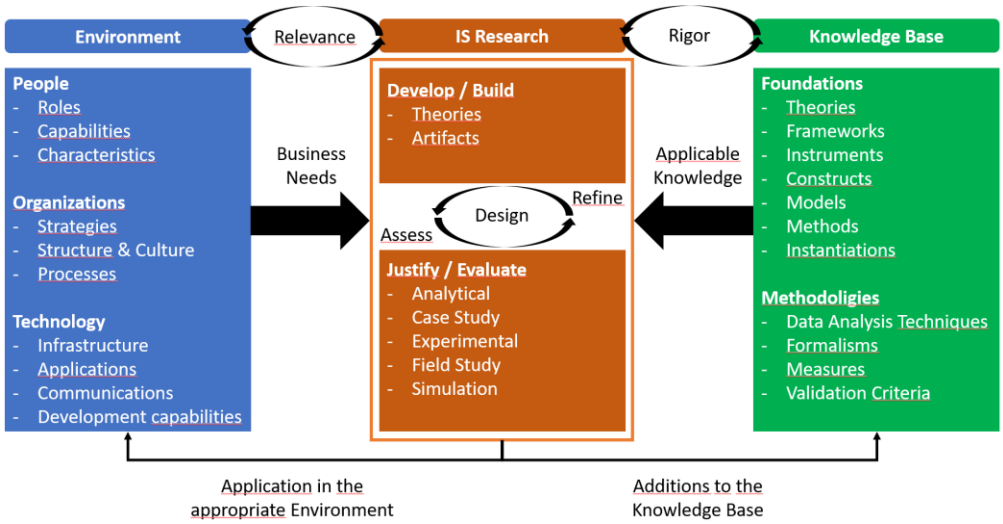

Figure 7: DSR model

Source: based on Hevner (2007)

[248] See Hevner (2007)
[249] See Peffers, Tuunanen, Rothenberger & Chatterjee (2007)

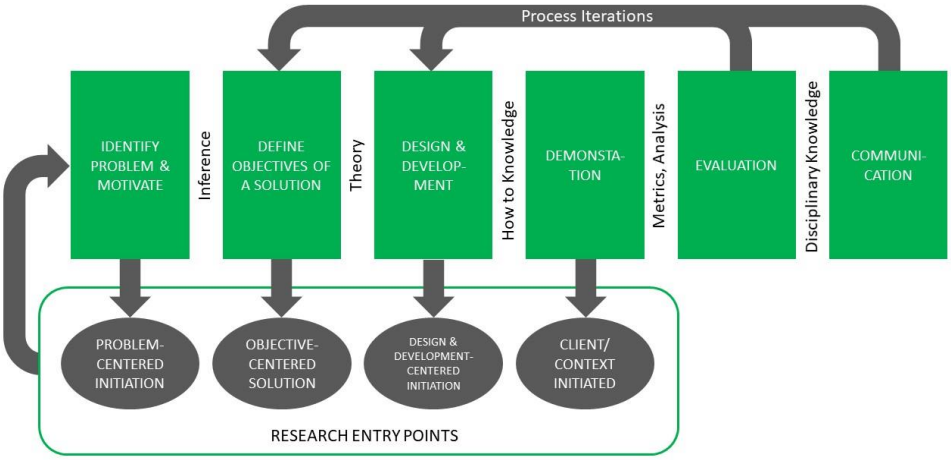

Figure 8: DSR application steps

Source: based on Peffers et al. (2007)

Q1: "What is the current business travel process for employees of SE?"

As a first step, DSR demands the identification of a problem in the environment.[250] To identify the problem, the author first had to understand the current business travel process for employees. For that, three approaches were used. First, a workshop with a small focus group was conducted. The group consisted of three employees of SE, who were regularly involved in business travel activities for the company. They were contacted via e-mail and given a short introduction of the research topic before the workshop. The goal of the workshop was to create a customer journey map (CJM), illustrating the individual steps and touchpoints that every employee had during business travel activities. To establish a common understanding of business travel, the author limited the scope to consider only sales-related business travel within Germany. The CJM approach was used because it enables researchers to understand the entire process of consideration from a user's perspective, allowing for refinement of real-life problems.[251] Other than providing the CJM's visual structure and general examples for steps and touchpoints, it was filled exclusively by the participants. At the end of the workshop, the participants were asked to name their three most prominent issues within this CJM. Additionally, they had the opportunity to formulate their requirements for an improved solution. After the workshop, the CJM was digitalized and refined, as in combining the same mentions for individual steps and touchpoints.

[250] See Peffers et al. (2007)
[251] See Marquez, Downey & Clement (2015)

For the second approach, the author validated and further refined the CJM by interviewing different employees individually. Two interviews with employees of SE, who were involved in business travel activities were conducted. Although only a few specific questions were prepared, the interview method used comes closest to the semi-structured interview, as they were open-ended questions and the interview included prior categorization.[252] Interviewees had the opportunity to comment on the CJM from the focus group and to provide additional steps or touchpoints that they experienced during their business travel. Again, these employees were then asked about their three most prominent issues with the current travel process. In order not to be biased by previous interviewees, the author provided them with the refined CJM from the workshop. After the author conducted all interviews, he consolidated all the results into one CJM and refined it once more.

As the third approach, the author analyzed the official company travel guideline for employees of SE to include the company perspective of the business travel process. These insights, together with the CJM, were used to model a business process diagram for the business travel process. The modeling method BPMN was used, as a variety of stakeholders can understand it, open-source visualization tools are available for free, and, according to White (2004), the transitioning process from design to implementation is seamless. Additionally, management of SE is acquainted with this modelling method and would be able to perceive it fast. Based on the collective insights of these three approaches, the author could identify the business travel process.

Q2: "What are the requirements stakeholders of SE have towards business travel?"

As a second step, DSR requires definition of the objectives of a solution, meaning to clarify what it has to accomplish to be better than the status quo.[253] In terms of this master's thesis, objectives translate into the requirements that the employees of SE have towards business travel and the business travel process. As mentioned previously, participants of the workshop were asked about their three most prominent issues with the current process and had the opportunity to formulate additional requirements. Besides, the author collected more requirements through three semi-structured interviews with selected employees of SE. These findings were then processed and included in an online survey format to help with validation,

[252] See Zhang & Wildemuth (2009)
[253] See Peffers et al. (2007)

but also exploration of new requirements. The survey method was chosen as potential participants were scattered around Germany and could not be invited for a centralized meeting.

The online survey was conducted via the online tools Survey Monkey. The author chose this tool as it has already been used for questioning SE employees before and was, therefore, easily accessible and understandable. Together with the travel manager of SE, the author identified a sample size of 15 employees as sufficient for the indented goal of validation, and generation of new requirements. The composition and demographics of the sample were mainly determined by the travel manager, as she did not want to overload certain individuals with too many surveys and had to respect company policy. The online survey consists of two parts. In the first part, the author applies the concepts of VBRE by including 21 items from the Portrait Values Questionnaire (PVQ) that are used to measure values.[254] Additionally, six questions about occupational motivations and five questions about emotions at the workplace, based on the work of Thew & Sutcliffe (2018), are asked in part one. All items in part one are based on the idea of comparing oneself to a specific person and indicating how similar an individual is to this particular person. The author uses this technique of formulating questions, as people find it easier to compare others to themselves than to identify what is important to them.[255] Similarity is indicated on a scale from one, not at all similar, to six, very similar. For deriving relevant results, a process similar to the novice mode, based on Thew & Sutcliffe (2018), is used. This means that initial VMEs from the workshop and interview participants are compared to the VMEs from the survey. The second part of the survey deals with the requirements of the business travel process. Providing the phases of business travel, that were concluded from the CJM workshop and interviews, respondents are asked open questions about their requirements for each of these phases. Based on research from Hull et al. (2017), they are instructed to begin their answers with: "I wish that", "I would like to be able to", and "I expect that". Afterward, respondents are confronted with the requirements previously formulated by their colleagues across all phases and have to assess their approval of that requirement on a scale from one, no approval, to six, total approval. Based on the results, requirements can be written, structured, and related to the previously defined VMEs.

[254] See Schwartz (2003)
[255] See Schwartz (2003)

Q3: "How can the requirements be included in the business travel process?"

The next step of the DSR methodology deals with the design and development of the artifact.[256] In the context of this thesis, the artifact translates to a software-based prototype that incorporates the requirements of employees of SE. The author decided for a software-based solution, as the processes related to business travel often require remote access by employees. Additionally, existing travel-related tools, such as a platform to hand in travel expenses, are already software-based and can potentially yield synergetic effects. For building the prototype, the structured and prioritized requirements from the previous step are translated to practical use cases. The author applies the use case template by Alrawashed et al. (2019) to formulate use cases that incorporate the two most important requirements. As for the prototype category, the mock-up is chosen by the author for the following reasons: First, it does not require technical feasibility, which the author could not provide based on his skillset. Second, it is visually unappealing, which makes it easier to design and protects users from overcommitment. Third, a mock-up provides the workflow that resembles operational processes, which is crucial for a solution that is supposed to be beneficial in real-life scenarios. The mock-up is designed using the software tool Adobe XD as it is a suitable tool for the task, and the author has access to it. The results of this third step are two digital mock-ups that represent use cases that incorporate employee requirements.

Q4: "How do the employees of SE evaluate the proposed artifact?

In a final step, DSR requires demonstration and evaluation of the artifact.[257] For this purpose, the author selects two employees of SE to get access to the two prototypes. After a brief introduction, the employees are told to interact with the prototype on their terms. They are asked to articulate their thoughts while using the prototype. The author documents these comments. Based on the comments about all three prototypes, the mock-up is iterated to include missing steps or correct false assumptions. Within the boundaries of this thesis, the final artifact is developed after one iteration.

[256] See Peffers et al. (2007)
[257] See Peffers et al. (2007)

4. Results

4.1 The current business travel process varies across individual employees but always incorporates three main phases

To present the answer the first subordinate research questions: **"what is the current business travel process for employees of SE?"**, the following subchapters are built iteratively. As mentioned in chapter three, first, a workshop was conducted to identify the current business travel process for employees of SE.

4.1.1 Workshop participants initially separate the business travel process into 64 process steps across eleven phases

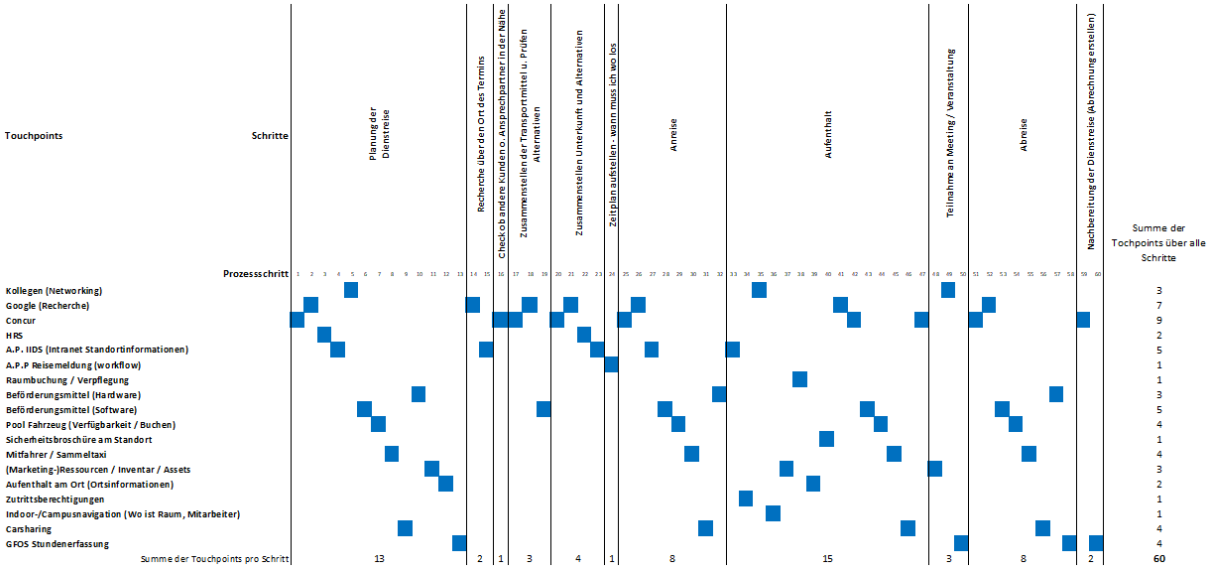

Figure 9: CJM from workshop

Figure 9 illustrates the digitalized and consolidated input from the workshop attendants. According to the participants, the eleven steps of the business travel process are:

- planning of the trip
- research on the designation
- research on other customers or contacts in the proximity
- consolidation of transport modes and research on alternatives
- consolidation of accommodation and research on alternatives
- creation of a timetable

- journey from home to designation
- at the designation
- participation in the objective of the business trip
- journey from designation to home
- post-processing

For every step, illustrated as columns in figure 9, participants assigned one or multiple touchpoints, illustrated as rows in figure 9. The initial list of touchpoints included:

- Colleagues
- Google
- Concur
- SE Intranet
- Business travel notification
- Conference room booking & catering
- Transportation (Hardware)
- Transportation (Software)
- Pool vehicle (availability and booking)
- Safety manual for destination (e.g., construction site)
- Car passenger
- Marketing material
- Location information
- Access control
- Indoor Navigation
- Carsharing (Hardware and Software)
- Time-tracking tool

A row indicating the overall count of process steps has been added above the touchpoints. For better illustration of the CJM, the author prohibits the possibility of multiple touchpoints being used at the same time. As seen, the current travel process consists of a total of 60 process steps across the eleven steps. The reason for the increased amount of process steps compared to regular steps is the possibility of individual touchpoints having multiple appearances across the whole process. Google, for example, is used in seven out of eleven steps. As these results only represent a small sample, two additional employees were asked

to comment on the CJM and to challenge or add steps, touchpoints, and their individual pain points.

4.1.2 Interviewees refine the CJM by providing additional steps, touchpoints, and pain points

Based on the input of the two interviewees, the CJM was improved further. Relevant alterations include the addition of steps with more detailed explanations of what actions they require and additional touchpoints. The author provides a detailed overview of the changes across the three iterations in table 5 for steps and in table 6 for touchpoints.

Figure 10 illustrates the CJM after incorporating the two interviewees' inputs. As seen in the illustration, the author divided all steps into three superordinate phases, including subphases. Additionally, the touchpoints were categorized in order to distinguish the most used categories for further processing. Next to the apparent changes in steps and touchpoints across these three iterations, other findings are worth mentioning. Across all three iterations, the phase with the most touchpoints was "during the business trip". Similarly, the "planning the business trip" phase is the second biggest over all iterations. The third phase, "post-processing of the business trip", however, received very little attention in the workshop regarding touchpoints, but turned out to be equally important as the planning phase by the third iteration. This is explained by the fact that the post-processing phase almost exclusively consists of actions regarding the touchpoint Concur, for which workshop participants did not provide as detailed steps as the interviewees. The quantity of individual touchpoint usage by category as of the third iteration is illustrated in table 7. It becomes clear that most steps during business travel either include tasks regarding administration, mobility and transport, or research.

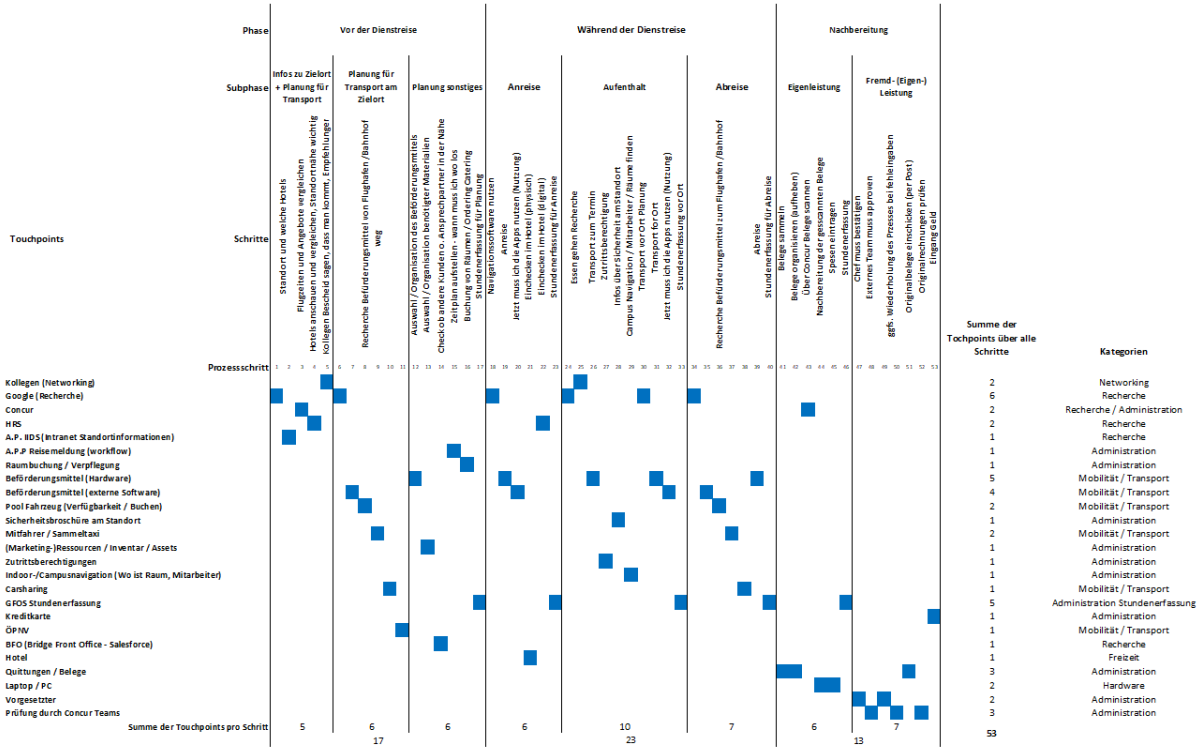

Figure 10: CJM after the third iteration

4.1.3 By incorporating the company travel guideline, the complete business travel process can be visualized using BPMN diagrams

The findings above provide a first overview of the current business travel process of SE from an employee's perspective. The management view, however, has not been included in the results so far. Consequently, the results provide only half of the complete picture. To incorporate the management perspective, the author received the official travel guideline of the company. After reviewing the document, it became clear that the business travel process can no longer be illustrated effectively using the CJM. The main reason for that decision is based on the CJMs inability to display alternative steps to a process. As a result, the author decided to create three individual BPMN diagrams for each of the main phases from the CJM, shown in figure 11, 12 and 13.

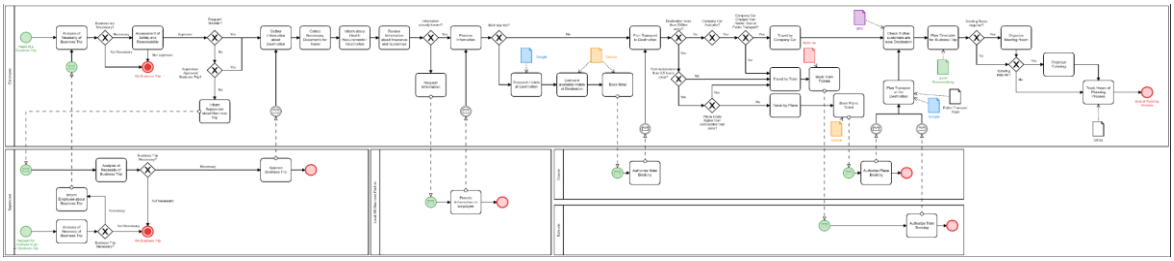

Figure 11: BPMN diagram - before the business trip

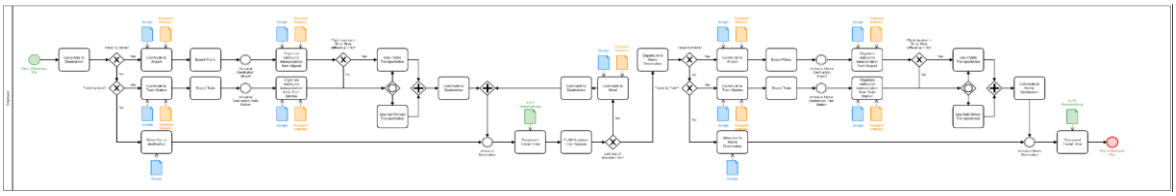

Figure 12: BPMN diagram - during the business trip

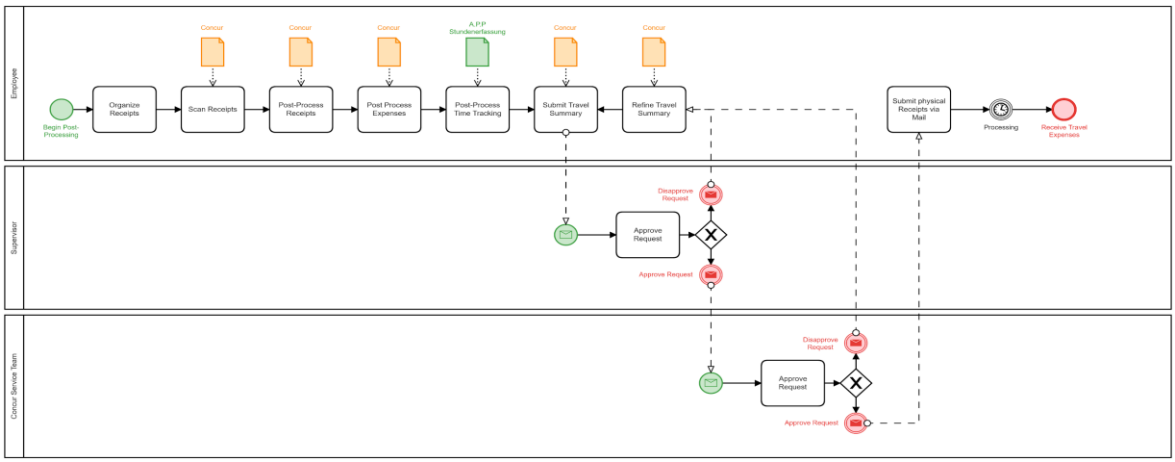

Figure 13: BPMN diagram - after the business trip

The above-shown BPMN diagrams include all steps and relevant touchpoints from the third iteration of the CJM as well as inputs from the company travel guideline. An example of an input can be found in figure x, where the decision of which transportation to choose is based on the distance to the destination in kilometers. Both the CJM and the BPMN diagrams provide an answer to the first subordinate research question (Q1) by illustrating the business travel process and its required steps and actions. Now that the business travel process has been identified, employee requirements for optimization of the process must be determined.

4.2 Requirements engineering yields the most relevant requirements employees have towards the business travel process

Answering the second subordinate research questions: **"what are the requirements stakeholders of SE have towards business travel?"**, is achieved by combining inputs from the workshop, the interviews, and the online survey.

4.2.1 Workshop participants and interviewees provide an initial list of requirements for optimization of the business travel process

At the end of the workshop, after the CJM was developed, participants were asked to individually write down their three most critical issues within the customer journey. Also, they were asked to formulate their requirements for how the process can be optimized for them. Interviewees were given the same possibility at the end of their interview sessions. Table 8 consolidates the results into a list of sixteen initial requirements. The categories from chapter 4.1.2 were also added to the table. Based on the received input, the author created six superordinate requirement categories for further processing. The most relevant requirement categories where then combined into seven requirements with the correct wording which can be seen in table 9. The author also added the phase of the business plan from the BPMN diagrams in chapter 4.3.1 to clarify when in the process the solution is required.

4.2.2 Survey participants validate the relevance of the initial requirements while adding additional requirements

The next step included validation of the consolidated requirements through participants of an online survey. Eleven employees took part in the validation section of the survey. The results of this section are displayed in Table 10. As seen in the table, R1, R6, and R7 display weighted average values of 5.00 or above. In all three cases, at least 81.82% of the respondents agree or totally agree with the proposed requirement. R5 is still a favorable requirement, with 63.64% of the respondents agreeing or totally agreeing. R2 and R3 only have a maximum of 36.37% agreeing or totally agreeing, making it difficult to justify further pursuing. R4 presents the lowest weighted average with 3.27 and also characterizes as the most controversial requirement, as 45.46% agree or totally agree and the same percentage disagrees or completely disagrees.

These results provide a first idea of what requirements to incorporate into the feature development process. However, two components are still missing to present a more robust and justified selection of requirements. First, the survey participants were allowed to formulate requirements across the three phases themselves. These have not been included in the results so far. Second, the survey included a section on personal values, and work-related motivations and emotions. As discussed in chapter three, these VMEs are crucial for the requirements engineering process of this thesis. They are presented in chapter 4.2.3. Table 11 shows the requirements after the survey participants' inputs were included. When applicable, the requirements were added to the already existing requirements. In that case, a survey respondent factor (SRF) was added to that requirement to indicate an increased value. Every match increased the factor by 0.10 points. If new requirements could not be assorted to existing items, that requirement was added to the list in table 12. Based on the weighted average from table 10 and the SRF, a requirement score (RS) was calculated.

After incorporating the requirements from the survey respondents, R7, R1, and R6 score the highest. The majority of requirements from the survey participants concern with post-processing in the phase "after the business trip". This comes close to the results from the weighted averages, where R7 scored the second-highest. For the "during the business trip phase", R1 now scores the second-highest in RS. Unified access control, as mentioned in R5, is the third-highest scoring requirement and falls into the "during the business trip" phase. These results now provide a more robust representation of the essential requirements for employees of SE. In the next chapter, one more step is conducted where the current findings are compared to the values, motivations, and emotions from the employees.

4.2.3 Applying value-based requirements engineering (VBRE) presents the final requirements document.

In the first section of the survey, employees were asked to evaluate their values, motivations, and emotions based on a standardized questionnaire. Twelve employees participated in this section. Table 13 through table 15 illustrate the results from the questionnaire. The author then matched these results with the seven requirements established earlier. A match was achieved when either the description or implications of the VMEs, discussed in chapter 2.7.4, could be assigned to a requirement. Regarding emotions, those that caused the requirement to be articulated were assigned. A mean value was derived from the weighted averages

across the VMEs, as seen in the fifth column. This mean was divided by ten to create a VME factor (VMEF) that is illustrated in column six. The FRS in table 16 was calculated by multiplying the RS from table 11 with the VMEF. The results indicate that R7 and R1 are the essential requirements for the business travel process and are therefore used for the next step: artifact development.

4.3 Artifact development for the two most relevant use cases, based on the employee requirements

The third subordinate research questions: "how can the requirements be included in the business travel process?", is answered by applying the two steps that were discussed in the methodology chapter. First, the requirements are translated into applicable use cases. Second, the use cases are illustrated using a mock-up prototype. The mock-ups serve as the artifact of the DSR methodology and represent the final deliverable of this thesis.

4.3.1 The use case template as the cornerstone of the prototype development

As a first step, both requirements were broken down into one use case for each of the requirements. For R1, the most relevant use case describes an employee that books transportation from A to B. For R2, the primary use case represents an employee that hands in their receipts and expenses for post-processing. Table 17 illustrates the use case template for R1 and table 18 for R7.

4.3.2 The preliminary deliverable: feature mock-ups for two use cases

In this chapter, the two use case templates from 4.3.1 are translated into mockups using Adobe XD. These mockups only represent the individual use case but are designed to be inclusive. Each mockup includes several screens that are described in the use case templates. Their alphabetical titles indicate the order of how the individual screens should be navigated. Figure 14 illustrates use case 1 and figure 15 use case 2.

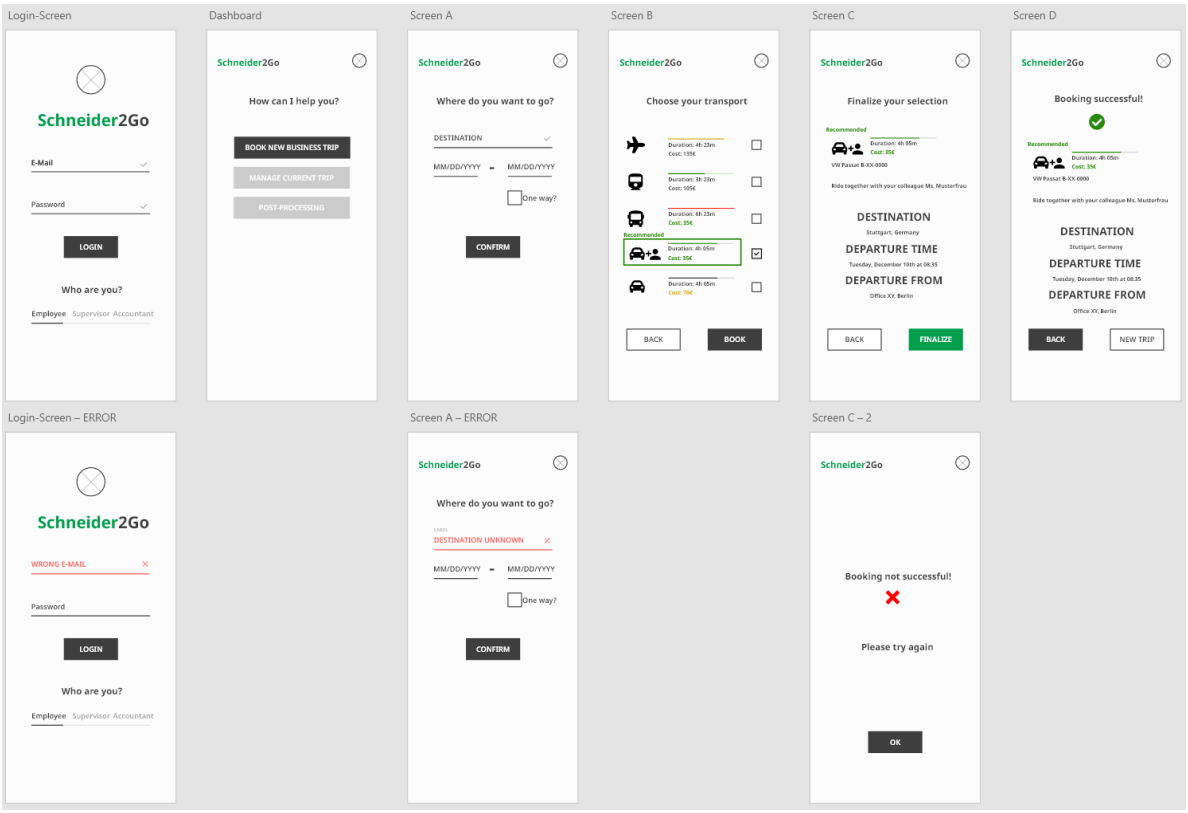

Figure 14: Mockup use case 1

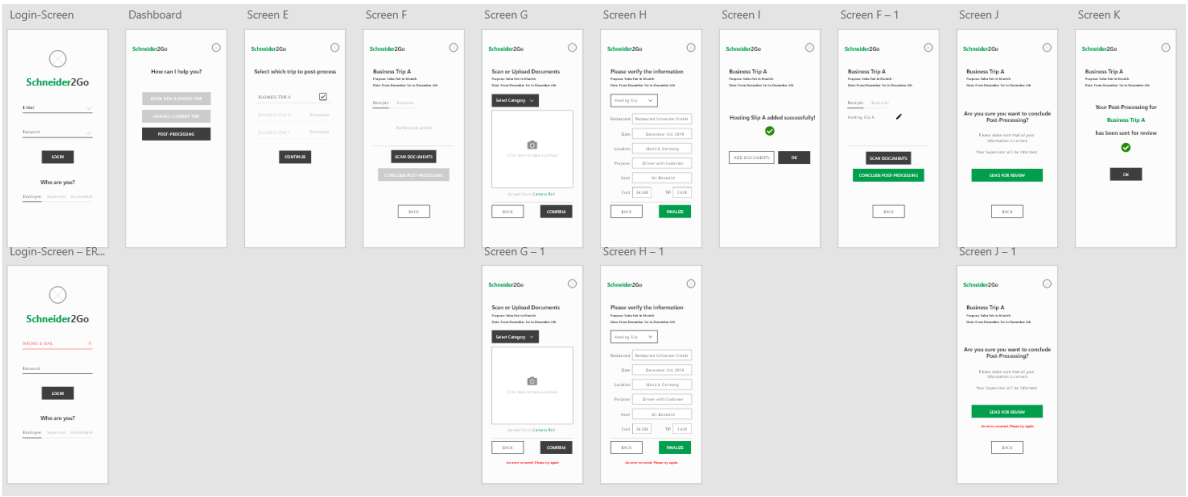

Figure 15: Mockup use case 2

4.4 The final deliverable is achieved after one iteration

Two employees of SE offered to provide feedback on both mockups. Their input can be seen in table 19. If possible, the input was always related to a specific screen. General feedback is listed at the bottom of the table. Figure 16 and figure 17 show the mockups after the feedback has been included. Screen specific feedback was included on the individual screen. The general feedback aims towards automation and stands as a non-functional requirement and supports earlier findings. However, automation could not be implemented in the mockups as they only represent the visual design perspective.

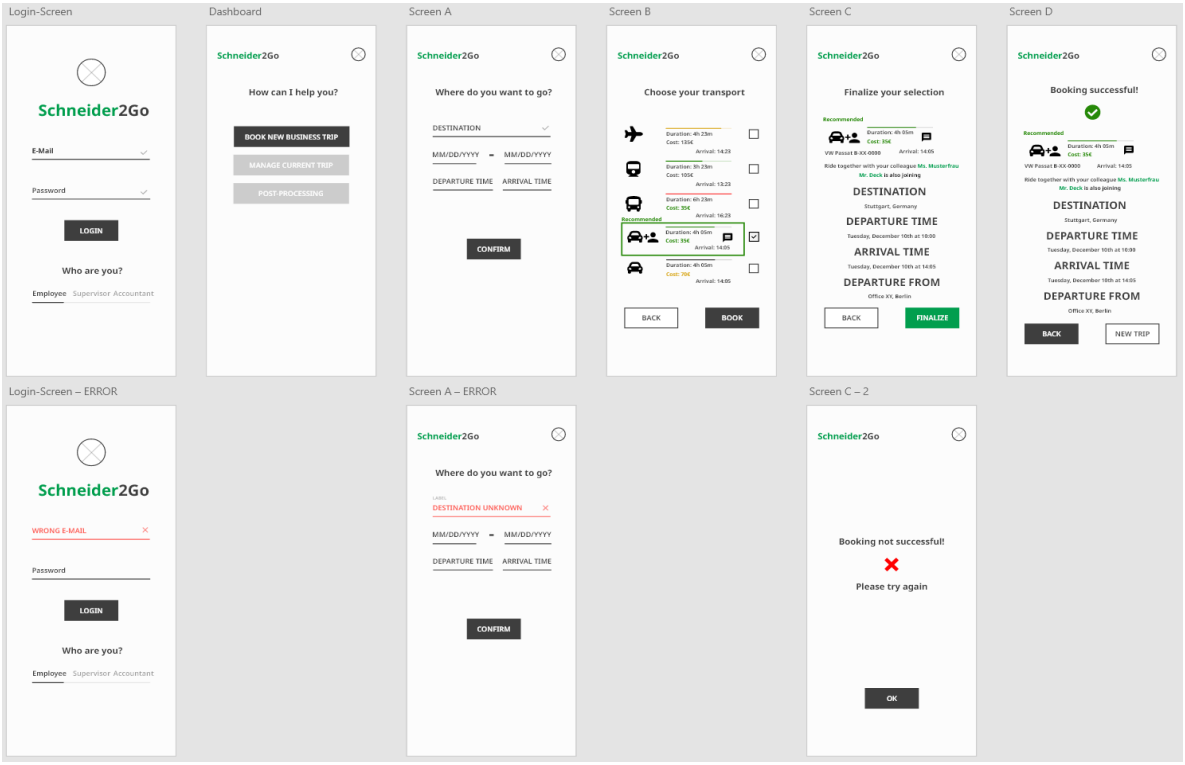

Figure 16: Final mockup use case 1

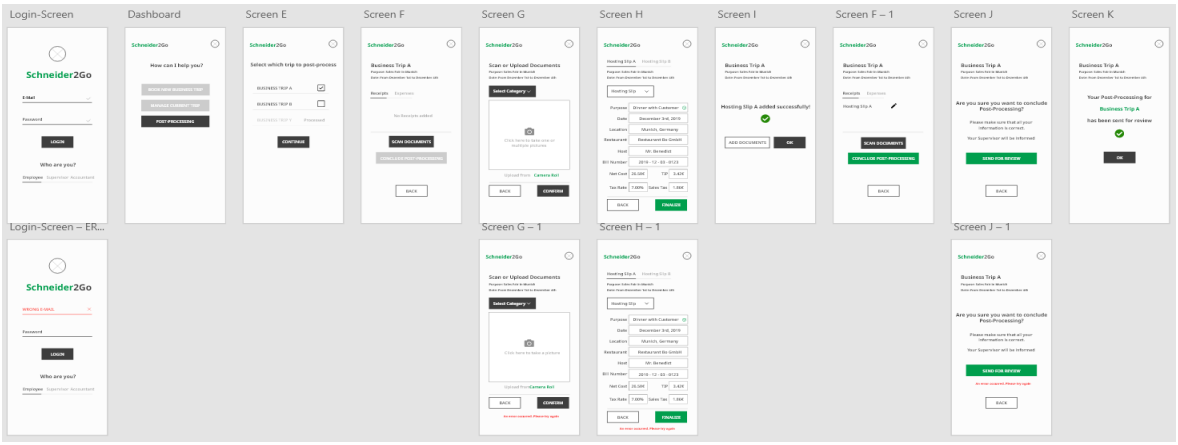

Figure 17: Final mockup use case 2

5. Discussion & Conclusion

5.1 This thesis contributes to requirements engineering by including creative processes for requirement discovery and solution development

The requirements engineering process, as highlighted by Hull et al. (2017), allows for different interpretations on how to elicit, process, and use stakeholder requirements. Aldave et al. (2019) support this multi-approach view by emphasizing researchers to focus on including creative techniques for requirement elicitation. In this thesis, the author applies the CJM as a starting point for identifying the user requirements towards business travel. In practice, however, the CJM is mostly used for displaying a sequence of steps that customers take when using a companies service or product.[258] Here, a customer is seen as an external entity that companies want to serve. In this thesis, the author shows that the CJM can also be used effectively for mapping the processes of internal customers, as in the companies employees. Especially for the field of business travel, it has been shown that without a clear understanding of how the end-user perceives the underlying business processes, a meaningful solution cannot be provided.

The thesis also includes the value-based requirement engineering approach, as discussed by Thew & Sutcliffe (2018). As this approach is relatively new, the thesis is likely amongst the first to provide insights on how it can be applied in practice. Especially towards the consideration of VMEs for software architecture, mentioned as a potential future research field by Thew & Sutcliffe (2018), this thesis provides practical insights. Values, motivations and emotions were especially helpful when trying to prioritize requirements. Regarding prioritization, a basic scoring model for quantifying the perceived stakeholder value of a requirement and combining that with scores in individual values, motivations, and emotions has been contributed to the VBRE field by this thesis.

Besides, the thesis takes the requirements engineering process beyond the development of requirements to the conceptualization of a software-based solution. By combining the

[258] See Rosenbaum, Otalora & Ramirez (2016)

requirement engineering approach with basic prototyping approaches, the final deliverables of this thesis exceed the standard elicitation of stakeholder requirements. The result of that are two mockups that mostly provide value for the company under consideration, but could, in theory, be applied for other companies or business fields.

5.2 Discussion of the results

The motivation of this thesis was to design a prototype for a solution that can optimize the business travel processes and experiences for employees of SE. Management of SE had to be involved in the process to define their expectations and set up boundaries of the research. Nevertheless, the results almost exclusively represent inputs from the employees and can, therefore, be seen as representative of this stakeholder group. The methodologies applied in this thesis that lead to the four subordinate research questions were highly beneficial towards this practical oriented research. Using the CJM as an entry point into mapping the business travel process turned out to be a suitable approach for the workshop participants and the author alike. After understanding the employees and their needs during a business trip, it became much more straightforward to transfer these processes into a digital solution. Requirements engineering and value-based requirements engineering serve as the core methodologies for elicitation, structuring and evaluation of requirements. Without them, the final deliverables could not have been developed in a similar quality. The design science research methodology helped to structure the progress and provide incentives to challenge and iterate previous findings continuously. Therefore, the author highly recommends these methodologies for similar research approaches.

The first subordinate research question aims at identifying the current business travel process for employees of SE. As seen in the results, the business travel process expands across three main phases. While the majority of steps are located in the "planning the business trip" and "during the business trip" phases, the most important requirement later was found in the "after the business trip" phase. Although these three phases were part of every iteration, it was interesting to see how much more detailed the third iteration was compared to the first. This supports the author in his decision to incorporate the two interviews for a better understanding of the complete process. In terms of touchpoints, the interviewees were especially important, as they contributed post-processing touchpoints that helped with the

use case definitions later. It also becomes clear that when individual steps and touchpoints are assigned to categories, automation, and mobility & transport, have the largest share of steps during the business travel process. Their importance was confirmed later in the research, as well. As the CJM reached its limits when steps involving decision making were incorporated, BPMN diagrams were utilized to deliver the final result for Q1.

The requirements engineering part answering the second subordinate research question stands as the most extensive part of this thesis. Based on the requirements from the workshop participants and interviewees, the author created an initial list of requirements. After categorizing these requirements, the author deduced that most administrative requirements were aiming at automation. For mobility & transport, the most could be assigned towards optimization, and for research activities, the majority could be assorted to centralization. The next step involved merging similar requirements. As a result, six requirements were formulated and distributed across the three phases of the business trip. Eleven additional employees then validated these requirements through a section in the online survey. The results, as seen in section 4.2.2, are discussed in the next paragraph.

R2, R3, and R4 scored too low and with answers too diverse and can, therefore, be seen as inconclusive. R1, R6, and R7 score the highest with at least 81.82% agreeing or totally agreeing. R1 and R7 further support the findings of 4.2.1 as they represent the most significant requirement categories centralization and automation. R6 overall scores the highest as it originates from a pain point that all participants can identify with. However, at this point, new requirements from the survey participants were incorporated, and scores changed. It is worth mentioning that the new requirements were situated before the validation of the requirements in the online survey to avoid biases. One answers that could not be assigned to previously defined requirements caused confusion for the author. A third of the employees required a physical assistant to administer their business travel tasks. This could be explained by the fact that in the past this was the standard for employees of the company. Reviewing the demographics of the survey participants supports this assumption, as half of the participants were between 46 and 65 years old, and most likely experienced this service themselves.

To conclude the requirements engineering part, value-based requirements engineering was applied and incorporated into the results. VMEs were added to matching requirements and weighted according to their score. After incorporating the VMEs, the ranking of the seven requirements did not change. This has two possible reasons. First, the VMEs supported the previous findings by being matched correctly to the requirements. Second, the VMEs weight was not significant enough to change already established scores. As the previous findings were robust, the author assumed the former to be the case. For R1 the author assigned self-direction, achievement, and frustration as the VMEs. According to Thew & Sutcliffe (2018), self-direction implies being able to choose action and thought individually. This manifests in the requirement of booking the business trip from alternative options. The motivation for doing so lies in the achievement of the business trip goal. The emotion that causes this requirement to be articulated is frustration with the current planning process. For R7, the author assigned conformity, achievement, and frustration. Conformity was chosen as post-processing requires norms and tax law guidelines to be followed. Interestingly, SE employees scored the lowest on conformity, indicating they do not identify with it. Low identification can be interpreted as a possibility to provide external assistance in this area, for example, through a software solution that simplifies the process. Based on these findings and assumptions, R1 and R7 were taken to the artifact development stage of the thesis.

Use case 1 and use case 2 were selected because of their balance between simplicity and impact. The main success scenario and the extensions from the use case template serve as the cornerstone of the prototype development in chapter 4.3.2. Each use case follows one single goal that is named in the goal section of the template. After development, the author showed both prototypes to two independent employees to gather user feedback. Their feedback proved to be valuable as the initial prototype lacked a few critical understandings from practical use. Again, their general feedback implied a focus on automation that further supports previous findings and confirmed the direction the research has lead to so far. There are, however, a few limitations to this thesis' research, which are discussed in the next chapter.

5.3 Limitations

The first and most significant limitation concerns the low generalizability of the findings. The research was conducted within a single company and included a specific type of employee. While the business travel process certainly offers some general relatability, the solution was tailored specifically for one addressee. Especially the VMEs cannot be generally applied as they are, and should be, highly individual. Another limitation was the small and homogenous employee sample. A company-wide survey would have helped in more robust validation and elicitation of additional requirements. Also, out of the total of 19 countable participants, only one female participated. This can be explained mostly by the field of business but potentially clouds the results by today's standards. It should also be pointed out that the prototype development process illustrated in this thesis only scratches the surface of what is needed to provide an actual software-based solution. The boundaries of this thesis only justified the development of two prototypes based on two use cases. In reality, each requirement would be equipped with a large number of use cases. This thesis also does not incorporate non-functional requirements into the prototype development as those are needed for a more advanced prototype design, but not necessarily for mockups. Additionally, the calculations of the final requirements scores were only achieved by using weighted averages and multiplication factors. There are certainly more sophisticated statistical methods that could be applied. Each VME was given the same weight for the calculations, although there might be differences in how they impact individual employees.

5.4 Future research and conclusion

Future work will extend across a few more steps. First, the findings will be distributed across a broader range of employees from the company to improve validation and the elicitation of additional requirements. Second, the most valuable use cases will be developed into actual software features, most likely as add-ons to already existing software. These features will then be tested in a small, closed environment and iterated upon using agile methodologies. Should the testing phases be promising, a stand-alone app could theoretically be possible if the right software development partners are found.

Externally, future work could include research on what internalities or externalities could cause individual VMEs to have different weights when measuring their scores. Meaning, it could be tried to evaluate whether values, motivations or emotions have the most significant impact on requirements, and prototype design respectively. As this thesis started with investigating the requirements first, it could also be investigated whether a significant prognosis of what requirements stakeholders have, can be made when analyzing the VMEs first. Moreover, it could be researched how the weight for VMEs differs across individuals. It would be highly practical to create superordinate VME profiles that can be attributed to different functional and non-functional requirements, hence, making the design process more targeted and effective.

In conclusion, this thesis accomplished the goal of designing an app prototype for business travel using value-based requirements engineering. It has been shown that travel managers must include new ways of managing and experiencing travel through innovative solutions. Understanding the requirements of stakeholders often involves seeing the world from their view. In terms of this thesis, this was achieved by developing the scenario "business trip" in cooperation with stakeholders. Through several iterations, the business trip was defined as a step involving three phases. The majority of the research was centered around requirement elicitation and validation, which proved to be the right approach when developing user-centered solutions. Stakeholder requirements were successfully incorporated into the three business trip phases and resulted in the manifestation of seven requirements a solution for the business travel process must accomplish. Out of these seven requirements, most could be validated through an online survey with three requirements scoring the highest in approval. After incorporating the stakeholders' values, motivations, and emotions, two requirements displayed the highest score and were taken to the creative process of prototype development. Using a use case template, the author created one mockup for each of the two requirements. Bringing the prototypes back to the origin of the process, the stakeholders, resulted in more feedback, which was used to further iterate upon the prototypes. Ultimately, the process highlighted in this thesis offers additions to theory and practice on how the requirement engineering process can be modified using creative and novel approaches, such as value-based requirements engineering.

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Annexure 1: Tables

Table 1: Phases and features of business travel

Pre-travel			During travel					Post travel	
Planning	**Booking**	**Itinerary consolidation**	**Cancellation/modification**	**Continuous support**	**Fast check-in/check-out**	**Transportation/hotel comfort**	**Extra travel information**	**Expenses**	**Reviews**
Door-to-door planning Peer reviews Discussion platform Professional social network	Preferencing Mobile payment Virtual agent Loyalty manager	Trip itinerary/ flight details Flight requirements (visa etc.) Loyalty manager Calendar sync	Alerts (delays etc.) Search for alternatives Re-booking Refunds	Flight/gate info Traffic info Airport maps Parking Bag tracker Timetables Meetings and events Security and assistance	Paperless check-in Advanced check-in (hotel/ Flight) Fast check-in/check out	Extra bag Lounge Airport store Seat choice Car type Mobile room key Upgrades Hotel menu Wake-up call	Local restaurants Discount possibilities	Pictures of expenses Uploading invoicing Expense approval	Events Suppliers Overall information Supplier reviews
Reviews/recommendation Local details/ news	Ability to book travel extensions for leisure	Trip sharing Social business travel				Tracking on social media Safe-arrival Weather Cash point	Vouchers Restaurant reviews Event and ticket purchases		

Source: based on CWT Travel Management Institute (2014)

Table 2: Requirement criteria

Criteria	Description
atomic	The statement displays a unique traceable element
unique	The statement is unique and has no duplicates
feasible	The statement is realistic in terms of schedule and operational cost
legal	The statement does not violate any laws
clear	The statement is readable by any stakeholder
precise	The statement is on point and brief
verifiable	The statement can be verified and is known how to
abstract	The statement does not imply a solution or design

Source: based on Hull et al. (2017)

Table 3: Values, Motivations and Emotions

Value	Description	Implication
Benevolence	Enhancement of wellbeing of people closest to oneself	Foster team cooperation
Universalism	Appreciation and protection of all people and nature	Build a sustainable CI and mindset
Self-Direction	Individual choice of action and thought	Facilitate flexibility at work
Stimulation	Excitement in novelties, pursue new challenges	Allow participation in creativity workshops
Hedonism	Enjoyment of oneself	Offer opportunities for leisure
Achievement	Demonstrating skills according to standards of society	Emphasize goal orientation, define project aims
Power	Prestige and status, command over resources and people	Distinguish responsibilities, control, create hierarchy
Security	Safety and stability of externalities and oneself	Identify and counteract threats
Conformity	Avoidance of violations of norms and expectations	Set up purposeful guidelines and norms
Tradition	Respect towards cultural customs	Create heterogeneous team composition
Motivation	**Description**	**Implication**
Power	Need to be in command and control others	Distinguish responsibilities, control, create hierarchy
Possession	Aspiration for wealth and material assets	Provide monetary incentives
Achievement	Need to organize and design things	Emphasize goal orientation, define project aims
Self-Esteem	Feeling satisfied with oneself	Build links between personal and project goals, reward achievements
Peer-Esteem	Feeling valued by others	Enable social feedback and praise, manage team composition
Sociability	Desire to be part of a consortium	Foster collaboration at project and organizational level
Emotion	**Description**	**Implication**
Fear	Being frightened, worried or threatened	Identify cause and remove threats
Pleasure	Being joyful and happy	No action required
Anxiety	Being uncertain about something	Define specifications and use scenarios for explanation
Frustration	Showing signs of anger and annoyance	Uncover interest or value conflicts
Depression	Being withdrawn and isolated	Engage stakeholders, remove potential barriers

Source: based on Thew & Sutcliffe (2018); Schwartz (2003)

Table 4: Use Case Template

Name	The title of the use case
Goal	The main goal of the use case
Actors	All stakeholders who are part of the use case
Preconditions	State a system must be in for the use case to be applicable
Postconditions	State a system could be in after the use case was performed
Invariants	State a system has during the course of the use case
Main Success Scenario	Set of actions that characterize when a use case's objective has been met
Variations	Set of alternative actions that can be performed to reach the use case's objective
Extensions	A system's response to exceptional circumstances that differ from the success scenario or it's variations
Included use cases	A set of Included use cases that are conditions for the use case to be met

Source: based on Alrawashed et al. (2019)

Table 5: CJM steps across iterations

1st iteration (after workshop)	2nd iteration (after 1st interview)	3rd iteration (after 2nd interview)
• Planning of the trip		
• research on the designation	• research destination & hotels	• research destination & hotels
• consolidation of accommodation and research on alternatives	• Research alternatives and offers	• Research alternatives and offers
	• Compare preselected hotels	• Compare preselected hotels
	• Inform colleagues at destination proximity	• Inform colleagues at destination proximity
	• Research transportation opportunities at destination	• Research transportation opportunities at destination
	• Research required (marketing) material	• Research required (marketing) material
• consolidation of transport modes and research on alternatives	• Research and select transportation	• Research and select transportation
• research on other customers or contacts in the proximity	• Check if other customers at destination or proximity	• Check if other customers at destination or proximity
• creation of a timetable	• Create timetable	• Create timetable
		• Book meetings rooms / catering
		• Track hours for planning
		• Plan Journey (navigation)

1st iteration (after workshop)	2nd iteration (after 1st interview)	3rd iteration (after 2nd interview)
• journey from home to destination (A to B)	• Journey from A to B	• Journey from A to B
	• Usage of transportation software (Apps)	• Usage of transportation software (Apps)
• During the business trip	• Arrive at destination/check-in hotel	• Arrive at destination/check-in hotel
		• Track hours for journey A to B
	• Research and plan meal opportunities	• Research and plan meal opportunities
• participation in the objective of the business trip	• Transport to business objective	• Transport to business objective
		• Get access control
		• Study safety instructions of destination
		• Find meeting room/destination
		• Plan transport at destination
	• Use transportation at destination	• Use transportation at destination
	• Usage of transportation software (Apps)	• Usage of transportation software (Apps)
		• Track hours for “at the destination”
	• Research transportation opportunities from destination	• Research transportation opportunities from destination
• journey from destination to home (B to A)	• Journey from B to A	• Journey from B to A
		• Track hours for journey B to A
• post-processing	• Collect all receipts	• Collect all receipts
		• organise all receipts
	• Scan receipts	• Scan receipts
	• Refine scanned receipts	• Refine scanned receipts
	• Add expenses	• Add expenses
		• Track hours for post-processing
	• Get supervisors approval	• Get supervisors approval
	• Get accountants approval	• Get accountants approval
	• (optional) repeat process	• (optional) repeat process
		• Send original receipts via mail
		• Get accountants approval
	• Receive expenses	• Receive expenses
Total amount of steps per iteration		
11	**25**	**39**

Table 6: CJM touchpoints across iterations

Original touchpoints	1st iteration	2nd iteration
• Colleagues	• Colleagues	• Colleagues
• Google	• Google	• Google
• Concur (travel software)	• Concur (travel software)	• Concur (travel software)
• HRS (hotel portal)	• HRS (hotel portal)	• HRS (hotel portal)
• SE intranet	• SE intranet	• SE intranet
• Business travel notification	• Business travel notification	• Business travel notification
• Conference room booking &	• Conference room booking &	• Conference room booking &
• Transportation (Hardware)	• Transportation (Hardware)	• Transportation (Hardware)
• Transportation (Software)	• Transportation (Software)	• Transportation (Software)
• Pool vehicle	• Pool vehicle	• Pool vehicle
• Safety manual for destination	• Safety manual for destination	• Safety manual for destination
• Car passenger	• Car passenger	• Car passenger
• Marketing material	• Marketing material	• Marketing material
• Location information	• Location information	• Location information
• Access control	• Access control	• Access control
• Indoor navigation	• Indoor navigation	• Indoor navigation
• Carsharing	• Carsharing	• Carsharing
• Time tracking tool	• Time tracking tool	• Time tracking tool
	• Credit card	• Credit card
	• Public Transport	• Public Transport
	• BFO (Salesforce)	• BFO (Salesforce)
	• Hotel	• Hotel
	• Receipts	• Receipts
	• Laptop / PC	• Laptop / PC
	• Supervisor	• Supervisor
	• External accountant	• External accountant
Total amount of touchpoints		
18	**26**	**26**

Table 7: Touchpoint categories and quantities

Category	Quantity (touchpoints from category used in # of steps)
Administration	22
Mobility and Transport	15
Research	12
Hardware	2
Networking	2
Leisure	1

Table 8: Initial Requirements

Pain Points / Requirements	#	Category	Requirement category	#
Concur has too little automation	3	Administration	Automation	**9**
Generally too little automation within the business travel process	2	Administration		
Concur is too advanced	2	Administration		
I want to have automated, real-time support for booking and when travel plans change	2	Administration		
Too many alternatives for research. What matches the guideline? What is the most (cost)efficient offer?	1	Research	Centralization	**4**
Information in the intranet is hard to find	1	Research		
Too many tools are needed for research	1	Research		
I want to be able to book marketing material across different corporate facilities	1	Administration		
Additional cost for the company due to missing car-pooling options	1	Mobility and Transport	Optimization	**4**
Not only cost but also sustainability (e.g. CO2 footprint) should be a consideration when travelling	1	Mobility and Transport		
I want to be able to choose from more transportation options when planning my business trip	2	Mobility and Transport		
Lack of standardized access control across corporate facilities	2	Administration	Standardization	**2**
No safety features (e.g. health insurance information) and support during business travel	1	Administration	Safety	**2**
I want to have support for my corporate car (Technical inspection)	1	Administration		
I want to be able to see how many employees are in the proximity (hotel, event, etc.)	1	Networking	Information	**2**
I want to be able to see the travel time for alternative transportation options	1	Mobility and Transport		
16	**23**	**16**	**6**	**23**

Table 9: Consolidated Requirements

Business Trip Phase (BTP)		Requirement (R)	Category (C)	Requirement Category (RC)
Before the business trip	**R1**	I want to have one dedicated, simple and smart booking-tool that shows me alternative travel and accommodation options and the estimated travel duration.	Research	Centralization
	R2	I want to emphasize CO2 reduction when traveling and want the company to incorporate and incentivize such behavior in the travel process	Mobility & Transport	Optimization
	R3	I want to see the inclusion of modern mobility options, such as car-pooling, car-sharing or ride-sharing.	Mobility & Transport	Optimization
During the business trip	**R4**	I would like to be able to see whom of my colleagues is in/at the same area / hotel / event.	Networking	Information
	R5	I want to have a digital assistant that informs me about next steps of the trip, answers my questions, and can support me with changes during the trip	Administration	Automation
	R6	I want to have unified access control across all company facilities	Administration	Standardization
After the business trip	**R7**	I want to have one dedicated, simple and smart post-processing tool that requires me to do as little manual steps as possible	Administration	Automation

Table 10: Validation results

R	1	2	3	4	5	6	Total	Weighted Average (WA)
R1	0.00% 0	0.00% 0	18.18% 2	0.00% 0	45.45% 5	36.36% 4	100.00% 11	**5.00**
R2	18.18% 2	0.00% 0	18.18% 2	36.36% 4	18.18% 2	9.09% 1	100.00% 11	**3.64**
R3	27.27% 3	9.09% 1	9.09% 1	9.09% 1	9.09% 1	27.27% 3	100.00% 11	**3.55**
R4	27.27% 3	18.18% 2	9.09% 1	0.00% 0	36.36% 4	9.09% 1	100.00% 11	**3.27**
R5	9.09% 1	9.09% 1	9.09% 1	9.09% 1	36.36% 4	27.27% 3	100.00% 11	**4.36**
R6	0.00% 0	0.00% 0	9.09% 1	0.00% 0	9.09% 1	81.82% 9	100.00% 11	**5.64**
R7	0.00% 0	0.00% 0	0.00% 0	9.09% 1	27.27% 3	63.64% 7	100.00% 11	**5.55**

Table 11: Consolidated Requirements and survey respondent factor

BTP	R		C	RC	WA	SRF	RS
Before the business trip	**R1**	I want to have one dedicated, simple and smart booking-tool that shows me alternative travel and accommodation options and the estimated travel duration.	Research	Centralization	5.00	1.40	**7.00**
	R2	I want to emphasize CO2 reduction when traveling and want the company to incorporate and incentivize such behavior in the travel process	Mobility & Transport	Optimization	3.64	1.00	**3.64**
	R3	I want to see the inclusion of modern mobility options, such as car-pooling, car-sharing or ride-sharing.	Mobility & Transport	Optimization	3.55	1.10	**3.91**
During the business trip	**R4**	I would like to be able to see whom of my colleagues is in/at the same area / hotel / event.	Networking	Information	3.27	1.10	**3.60**
	R5	I want to have a digital assistant that informs me about next steps of the trip, answers my questions, and can support me with changes during the trip	Administration	Automation	4.36	1.20	**5.23**
	R6	I want to have unified access control across all company facilities	Administration	Standardization	5.64	1.00	**5.64**
After the business trip	**R7**	I want to have one dedicated, simple and smart post-processing tool that requires me to do as little manual steps as possible	Administration	Automation	5.55	1.70	**9.44**

Table 12: New requirements of survey participants

Requirements	#	Category	Requirement category
I want to be flexible in the planning phase so I can serve my customers' needs appropriately	3	Research	Optimization
I want to have insurances on the timetable proposed by a tool	1	Research	Optimization
I want to have a better awareness of the traffic situation as the built-in navigation does not offer real time alerts.	1	Mobility & Transport	Information
I want to have enough time to serve the needs of the customer	2	Administration	Optimization
I want to have a physical assistant, that does all the travel related work for me	4	Administration	Automation

Table 13: Employee Values

Q	1	2	3	4	5	6	Total	Weighted Average (WA)
Benevolence (BE)								**5.00**
Q12	0.00% 0	0.00% 0	8.33% 1	16.67% 2	50.00% 6	25.00% 3	100.00% 12	4.92
Q18	0.00% 0	0.00% 0	8.33% 1	16.67% 2	33.33% 4	41.67% 5	100.00% 12	5.08
Universalism (UN)								**4.55**
Q3	8.33% 1	0.00% 0	0.00% 0	33.33% 4	58.33% 7	0.00% 0	100.00% 12	4.33
Q8	0.00% 0	0.00% 0	8.33% 1	25.00% 3	50.00% 6	16.67% 2	100.00% 12	4.75
Q19	0.00% 0	0.00% 0	8.33% 1	33.33% 4	50.00% 6	8.33% 1	100.00% 12	4.58
Self-Direction (SD)								**4.67**
Q1	8.33% 1	0.00% 0	0.00% 0	16.67% 2	41.67% 5	33.33% 4	100.00% 12	4.83
Q11	0.00% 0	8.33% 1	0.00% 0	33.33% 4	50.00% 6	8.33% 1	100.00% 12	4.50
Stimulation (ST)								**4.04**
Q6	0.00% 0	0.00% 0	16.67% 2	50.00% 6	25.00% 3	8.33% 1	100.00% 12	4.25
Q15	0.00% 0	8.33% 1	16.67% 2	58.33% 7	16.67% 2	0.00% 0	100.00% 12	3.83
Hedonism (HE)								**4.50**
Q10	0.00% 0	0.00% 0	0.00% 0	33.33% 4	50.00% 6	16.67% 2	100.00% 12	4.83
Q21	0.00% 0	8.33% 1	25.00% 3	16.67% 2	41.67% 5	8.33% 1	100.00% 12	4.17
Achievement (AC)								**4.86**
Q4	0.00% 0	0.00% 0	0.00% 0	50.00% 6	41.67% 5	8.33% 1	100.00% 12	4.58
Q13	0.00% 0	0.00% 0	0.00% 0	16.67% 2	50.00% 6	33.33% 4	100.00% 12	5.17

Power (PO)								**3.63**
Q2	8.33% 1	25.00% 3	16.67% 2	41.67% 5	8.33% 1	0.00% 0	100.00% 12	3.17
Q17	0.00% 0	8.33% 1	0.00% 0	66.67% 8	25.00% 3	0.00% 0	100.00% 12	4.08
Security (SC)								**4.63**
Q5	0.00% 0	0.00% 0	0.00% 0	41.67% 5	50.00% 6	8.33% 1	100.00% 12	4.67
Q14	0.00% 0	0.00% 0	25.00% 3	8.33% 1	50.00% 6	16.67% 2	100.00% 12	4.58
Conformity (CO)								**3.54**
Q7	0.00% 0	25.00% 3	33.33% 4	25.00% 3	16.67% 2	0.00% 0	100.00% 12	3.33
Q16	0.00% 0	8.33% 1	41.67% 5	25.00% 3	16.67% 2	8.33% 1	100.00% 12	3.75
Tradition (TR)								**3.71**
Q9	0.00% 0	25.00% 3	33.33% 4	16.67% 2	25.00% 3	0.00% 0	100.00% 12	3.42
Q20	0.00% 0	16.67% 2	16.67% 2	25.00% 3	33.33% 4	8.33% 1	100.00% 12	4.00

Table 14: Employee Occupational Motivations

Q	1	2	3	4	5	6	Total	Weighted Average (WA)
Power (PO)								**3.42**
Q1	8.33% 1	8.33% 1	25.00% 3	50.00% 6	8.33% 1	0.00% 0	100.00% 12	
Possession (PS)								**4.55**
Q2	0.00% 0	8.33% 1	16.67% 2	41.67% 5	25.00% 3	8.33% 1	100.00% 12	
Achievement (AC)								**4.92**
Q3	0.00% 0	0.00% 0	8.33% 1	25.00% 3	50.00% 6	16.67% 2	100.00% 12	
Self-Esteem (SE)								**5.08**
Q4	0.00% 0	0.00% 0	16.67% 2	0.00% 0	41.67% 5	41.67% 5	100.00% 12	
Peer-Esteem (PE)								**4.67**
Q5	0.00% 0	0.00% 0	0.00% 0	50.00% 6	33.33% 4	16.67% 2	100.00% 12	
Sociability (SO)								**4.92**
Q6	0.00% 0	0.00% 0	0.00% 0	33.33% 4	41.67% 5	25.00% 3	100.00% 12	

Table 15: Employee Occupational Emotions

Q	1	2	3	4	5	6	Total	Weighted Average (WA)
Fear (FE)								**2.42**
Q1	25.00% 3	25.00% 3	41.67% 5	0.00% 0	8.33% 1	0.00% 0	100.00% 12	
Pleasure (PL)								**5.00**
Q2	0.00% 0	8.33% 1	0.00% 0	0.00% 0	66.67% 8	25.00% 3	100.00% 12	
Anxiety (AN)								**2.42**
Q3	16.67% 2	41.67% 5	25.00% 3	16.67% 2	0.00% 0	0.00% 0	100.00% 12	

Frustration (FR)								**3.33**
Q4	0.00% 0	25.00% 3	50.00% 6	8.33% 1	0.00% 0	16.67% 2	100.00% 12	
Depression (DE)								**2.92**
Q5	8.33% 1	33.33% 4	25.00% 3	525.00% 3	8.33% 1	0.00% 0	100.00% 12	

Table 16: Final requirement score

R	V	M	E	Mean	VMEF	RS	FRS
R1	SD	AC	FR				
	4.67	4.92	3.33	4.31	1.43	7.00	**10.01**
R2	UN	SE	FR				
	4.55	5.08	3.33	4.32	1.43	3.64	**5.21**
R3	SD	AC	FR				
	4.67	4.92	3.33	4.31	1.43	3.91	**5.59**
R4	BE	PE	DE				
	5.00	4.67	2.92	4.20	1.42	3.60	**5.11**
R5	SE	AC	AN				
	4.63	4.92	2.42	3.99	1.40	5.23	**7.32**
R6	SD	AC	FR				
	4.67	4.92	3.33	4.31	1.43	5.64	**8.07**
R7	CO	AC	FR				
	3.54	4.92	3.33	3.93	1.39	9.44	**13.12**

Table 17: Use case template for R1

Name	Use Case 1: Book transportation for business trip
Goal	Allow an authorized user to book transportation for a business trip from A to B through an app
Actors	Employee, Supervisor
Preconditions	The user has the right credentials, the system has access to the internet
Postconditions	Confirmation email sent to user
Invariants	None
Main Success Scenario	01 User enters CREDENTIALS 02 IF CREDENTIALS are valid THEN 03 APP sends user to dashboard 04 User selects BOOK NEW BUSINESS TRIP from available actions 05 APP sends user to screen a 06 User enters DESTINATION and DURATION of business trip and confirms 07 IF DESTINATION and DURATION are valid THEN 08 APP sends user to screen b 09 User chooses from one of the transportation options by clicking BOOK 10 APP sends user to screen c 11 User confirms transportation option by clicking FINALIZE 12 IF order can be processed THEN 13 APP sends user to confirmation successful screen d 14 Confirmation email is sent to user
Variations	None
Extensions	02a ELSE APP presents an error message 02b AND asks the user to re-enter CREDENTIALS 08a ELSE APP presents an error message 08b AND asks the user to re-enter DESTINATION and DURATION 12a ELSE APP presents an error message 12b AND user is sent back to screen c
Included use cases	For example: User creation

Table 18: Use case template for R2

Name	Use case 2: Upload receipts of business trip
Goal	Allow an authorized user to upload receipts for a business trip through an app
Actors	Employee, supervisor, accountant
Preconditions	The user has the right credentials, the system has access to the internet
Postconditions	Confirmation email sent to user, supervisor and accountant
Invariants	None
Main Success Scenario	01 User enters CREDENTIALS 02 IF CREDENTIALS are valid THEN 03 APP sends user to dashboard 04 User selects POST-PROCESSING from available actions 05 APP sends user to screen e 06 User selects BUSINESS TRIP A from available actions and clicks CONTINUE 07 APP sends user to screen f 06 User selects SCAN DOCUMENTS from available actions 07 APP sends user to screen g 08 User confirms upload or scan by clicking CONFIRM 09 IF SCAN is valid THEN 10 APP sends user to screen h 09 User checks the auto-filled fields and edits if necessary 10 User confirms input by clicking FINALIZE 11 IF information can be processed THEN 12 APP sends user to successful screen i 13 User repeats the process until all receipts are processed 14 User selects CONCLUDE POST-PROCESSING for the selected business trip via screen f 15 IF at least one document has been uploaded THEN 16 APP sends user to confirmation screen j 17 User confirms by clicking SEND FOR REVIEW 18 IF information can be processed THEN 19 APP sends user to confirmation screen k 20 Confirmation email sent to user, supervisor and accountant
Variations	None
Extensions	02a ELSE APP presents an error message 02b AND asks the user to re-enter CREDENTIALS 09a ELSE APP presents an error message 09b AND asks the user to re-scan the document 11a ELSE APP presents an error message 11b AND user is sent back to screen h 15a ELSE APP does not allow the CONCLUDE POST PROCESSING button to appear 18a ELSE APP presents error message 18b AND user is sent back to screen j
Included use cases	None

Table 19: Feedback on mockups

Employee	Use Case	Screen	Feedback
1	1	A	It would be nice to be able to set departure and arrival time as an input field
1	1	B, C	It would be nice to see the departure and arrival time
2	1	A	"One way" checkbox is confusing. Use case is only for one way anyways
2	1	B	For ride sharing, it would be nice to contact the employee before booking
2	1	C, D	Also, I want to be able to see who else is riding
1	2	H	Indicate whether net or gross cost
1	2	H	Add, Bill Number Tax Rate and Sales Tax amount (needed for most invoices)
2	2	G	Possibility to upload multiple scans for the same category would be nice
2	2	H	Purpose dropdown with predefined options would be nice
General Feedback			
1	There must be as little manual input as possible. I lose a lot of time for planning and post processing right now		
2	Automation is key here. That's where the current tool lacks effectiveness		

Annexure 2: CJM

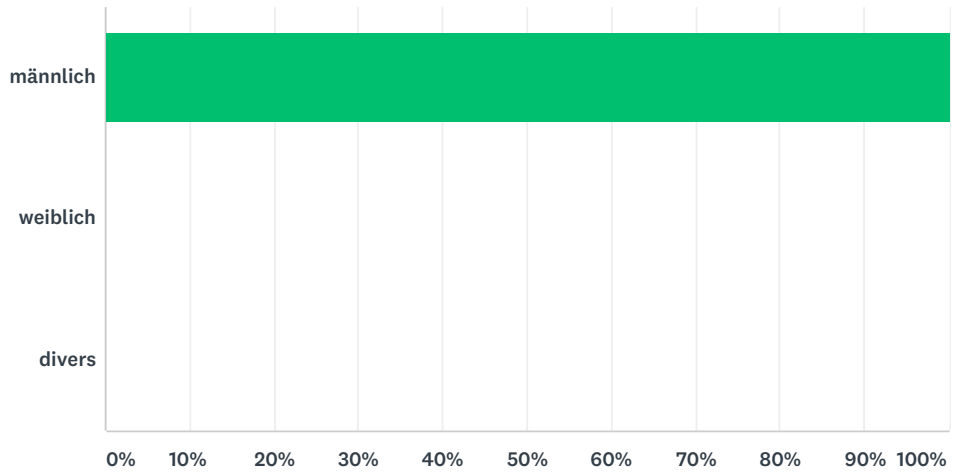
Phase	Subphase	Prozessschritt	Schritte	Touchpoint	Summe der Touchpoints pro Schritt (Subphase)	Summe (Phase)
Vor der Dienstreise	Infos zu Zielort + Planung für Transport	1	Standort und welche Hotels	Google (Recherche)	5	17
		2		A.P. IIDS (Intranet Standortinformationen)		
		3	Flugzeiten und Angebote vergleichen	Concur		
		4	Hotels anschauen und vergleichen, Standortnähe wichtig	HRS		
		5	Kollegen Bescheid sagen, dass man kommt, Empfehlungen	Kollegen (Networking)		
	Planung für Transport am Zielort	6	Recherche Beförderungsmittel von Flughafen /Bahnhof weg	Google (Recherche)	6	
		7		Beförderungsmittel (externe Software)		
		8		Pool Fahrzeug (Verfügbarkeit / Buchen)		
		9		Mitfahrer / Sammeltaxi		
		10		Carsharing		
		11		ÖPNV		
	Planung sonstiges	12	Auswahl / Organisation des Beförderungsmtitels	Beförderungsmittel (Hardware)	6	
		13	Auswahl / Organisation benötigter Materialien	(Marketing-)Ressourcen / Inventar / Assets		
		14	Check ob andere Kunden o. Ansprechpartner in der Nähe	BFO (Bridge Front Office - Salesforce)		
		15	Zeitplan aufstellen - wann muss ich wo los	A.P.P Reisemeldung (workflow)		
		16	Buchung von Räumen / Ordering Catering	Raumbuchung / Verpflegung		
		17	Stundenerfassung für Planung	GFOS Stundenerfassung		
Während der Dienstreise	Anreise	18	Navigationssoftware nutzen	Google (Recherche)	6	23
		19	Anreise	Beförderungsmittel (Hardware)		
		20	Jetzt muss ich die Apps nutzen (Nutzung)	Beförderungsmittel (externe Software)		
		21	Einchecken im Hotel (physisch)	Hotel		
		22	Einchecken im Hotel (digital)	HRS		
		23	Stundenerfassung für Anreise	GFOS Stundenerfassung		
	Aufenthalt	24	Essen gehen Recherche	Google (Recherche)	10	
		25		Kollegen (Networking)		
		26	Transport zum Termin	Beförderungsmittel (Hardware)		
		27	Zutrittsberechtigung	Zutrittsberechtigungen		
		28	Infos über Sicherheit am Standort	Sicherheitsbroschüre am Standort		
		29	Campus Navigation / Mitarbeiter / Räume finden	Indoor-/Campusnavigation (Wo ist Raum, Mitarbeiter)		
		30	Transport vor Ort Planung	Google (Recherche)		
		31	Transport for Ort	Beförderungsmittel (Hardware)		
		32	Jetzt muss ich die Apps nutzen (Nutzung)	Beförderungsmittel (externe Software)		
		33	Stundenerfassung vor Ort	GFOS Stundenerfassung		
	Abreise	34	Recherche Beförderungsmittel zum Flughafen /Bahnhof	Google (Recherche)	7	
		35		Beförderungsmittel (externe Software)		
		36		Pool Fahrzeug (Verfügbarkeit / Buchen)		
		37		Mitfahrer / Sammeltaxi		
		38		Carsharing		
		39	Abreise	Beförderungsmittel (Hardware)		
		40	Stundenerfassung für Abreise	GFOS Stundenerfassung		
Nachbereitung	Eigenleistung	41	Belege sammeln	Quittungen / Belege	6	13
		42	Belege organisieren (aufheben)	Quittungen / Belege		
		43	Über Concur Belege scannen	Concur		
		44	Nachbereitung der gesscannten Belege	Laptop / PC		
		45	Spesen eintragen	Laptop / PC		
		46	Stundenerfassung	GFOS Stundenerfassung		
	Fremd- (Eigen-) Leistung	47	Chef muss bestätigen	Vorgesetzter	7	
		48	Externes Team muss approven	Prüfung durch Concur Teams		
		49	ggfs. Wiederholung des Przesses bei fehleingaben	Vorgesetzter		
		50		Prüfung durch Concur Teams		
		51	Originalbelege einschicken (per Post)	Quittungen / Belege		
		52	Originalrechnungen prüfen	Prüfung durch Concur Teams		
		53	Eingang Geld	Kreditkarte		

Touchpoints	Summe der Tochpoints über alle Schritte	Kategorien
Kollegen (Networking)	2	Networking
Google (Recherche)	6	Recherche
Concur	2	Recherche / Administration
HRS	2	Recherche
A.P. IIDS (Intranet Standortinformationen)	1	Recherche
A.P.P Reisemeldung (workflow)	1	Administration
Raumbuchung / Verpflegung	1	Administration
Beförderungsmittel (Hardware)	5	Mobilität / Transport
Beförderungsmittel (externe Software)	4	Mobilität / Transport
Pool Fahrzeug (Verfügbarkeit / Buchen)	2	Mobilität / Transport
Sicherheitsbroschüre am Standort	1	Administration
Mitfahrer / Sammeltaxi	2	Mobilität / Transport
(Marketing-)Ressourcen / Inventar / Assets	1	Administration
Zutrittsberechtigungen	1	Administration
Indoor-/Campusnavigation (Wo ist Raum, Mitarbeiter)	1	Administration
Carsharing	1	Mobilität / Transport
GFOS Stundenerfassung	5	Administration Stundenerfassung
Kreditkarte	1	Administration
ÖPNV	1	Mobilität / Transport
BFO (Bridge Front Office - Salesforce)	1	Recherche
Hotel	1	Freizeit
Quittungen / Belege	3	Administration
Laptop / PC	2	Hardware
Vorgesetzter	2	Administration
Prüfung durch Concur Teams	3	Administration
Summe der Touchpoints pro Schritt	**53**	

Annexure 3: Survey responses

Q1 Was ist Dein Geschlecht?

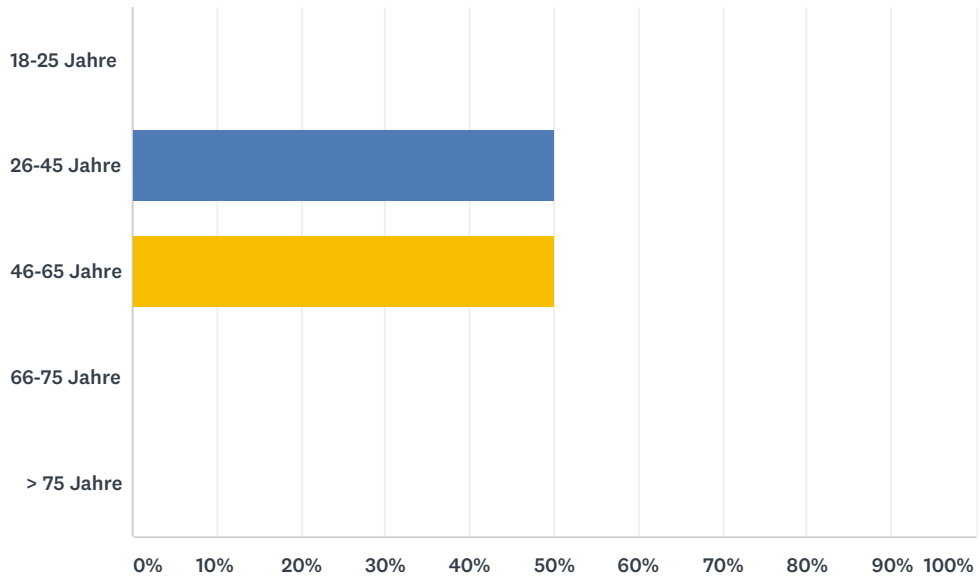
Answered: 18 Skipped: 0



ANSWER CHOICES	RESPONSES	
männlich	100.00%	18
weiblich	0.00%	0
divers	0.00%	0
TOTAL		18

Q2 Welcher Altersgruppe gehörst Du an?

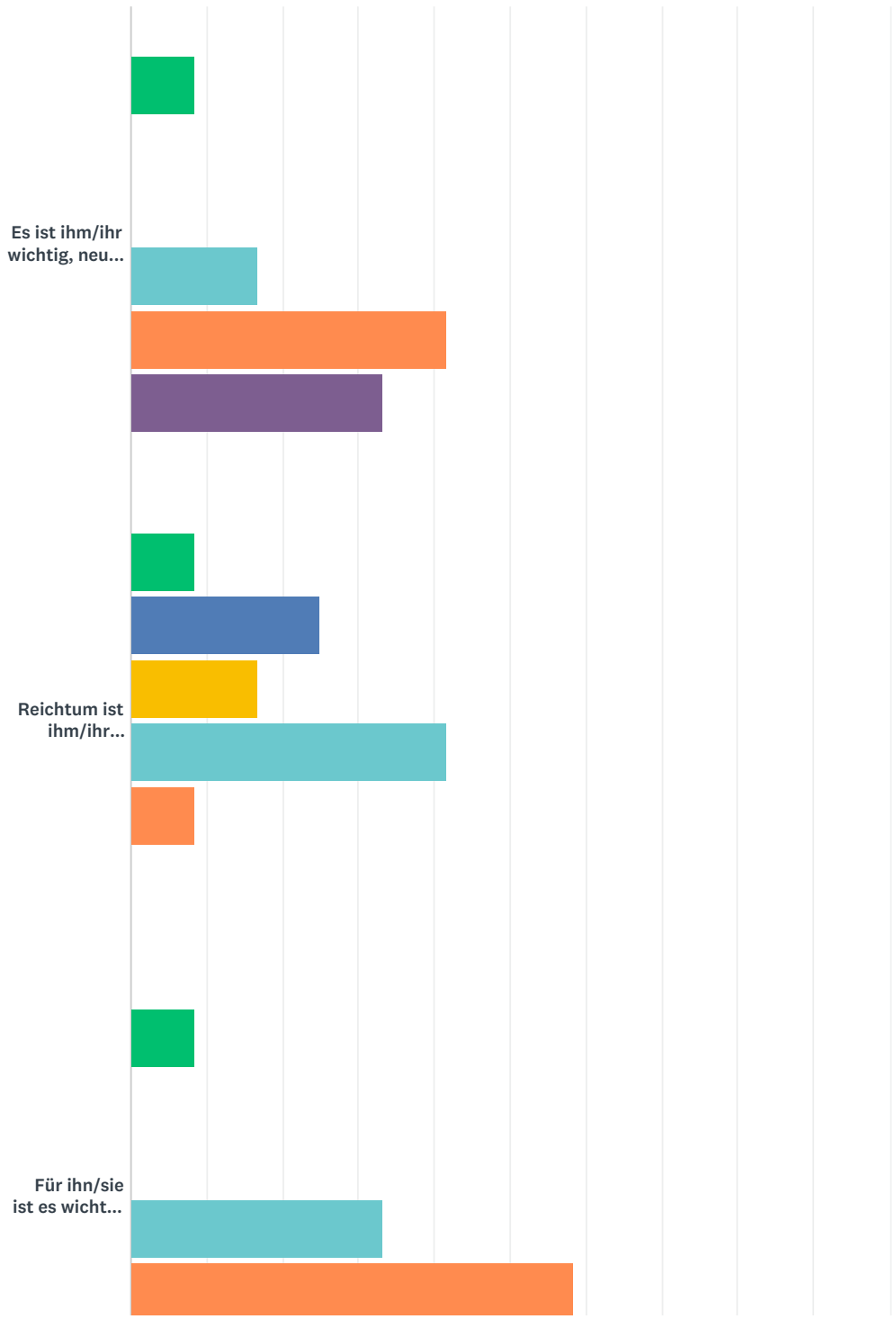
Answered: 18 Skipped: 0

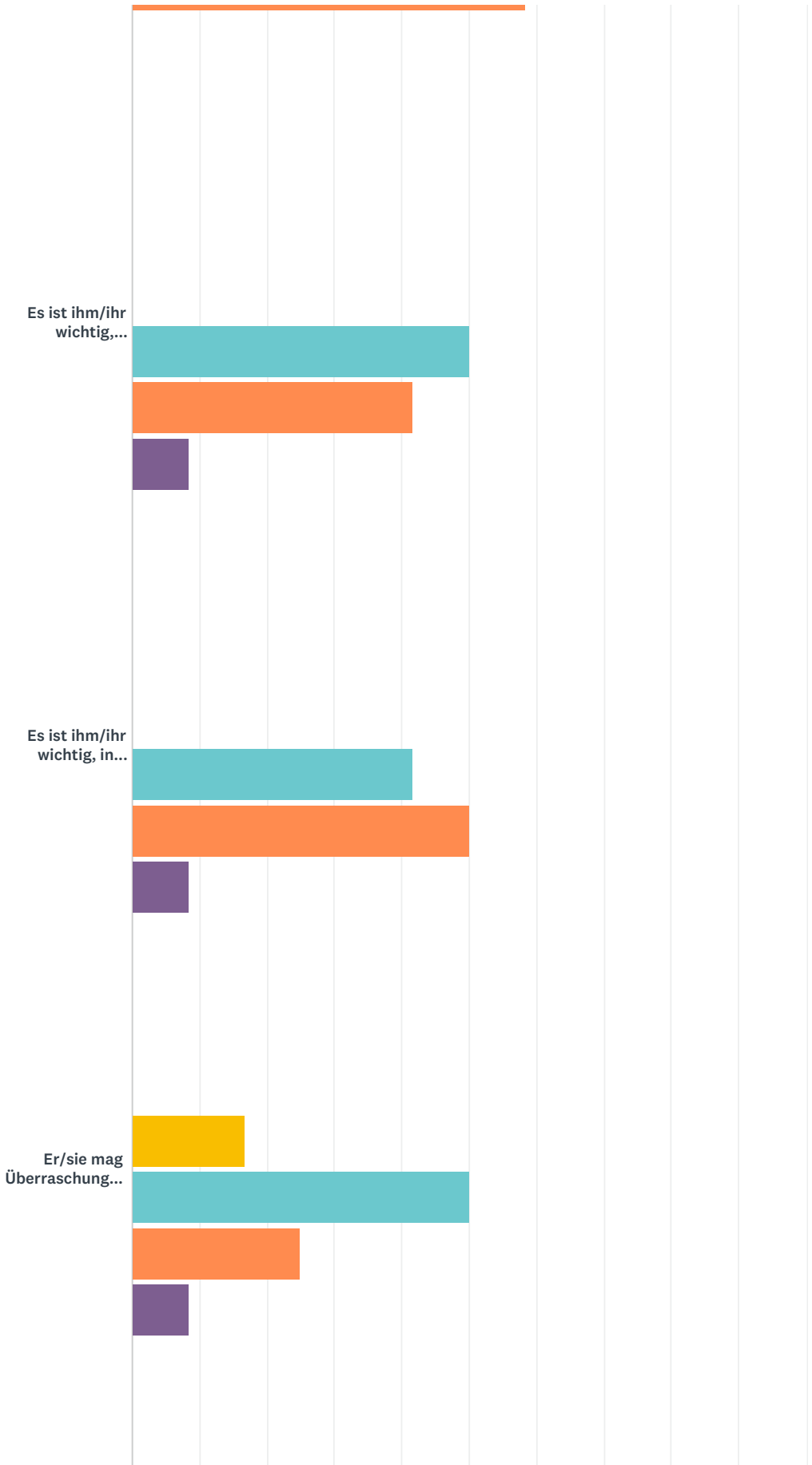


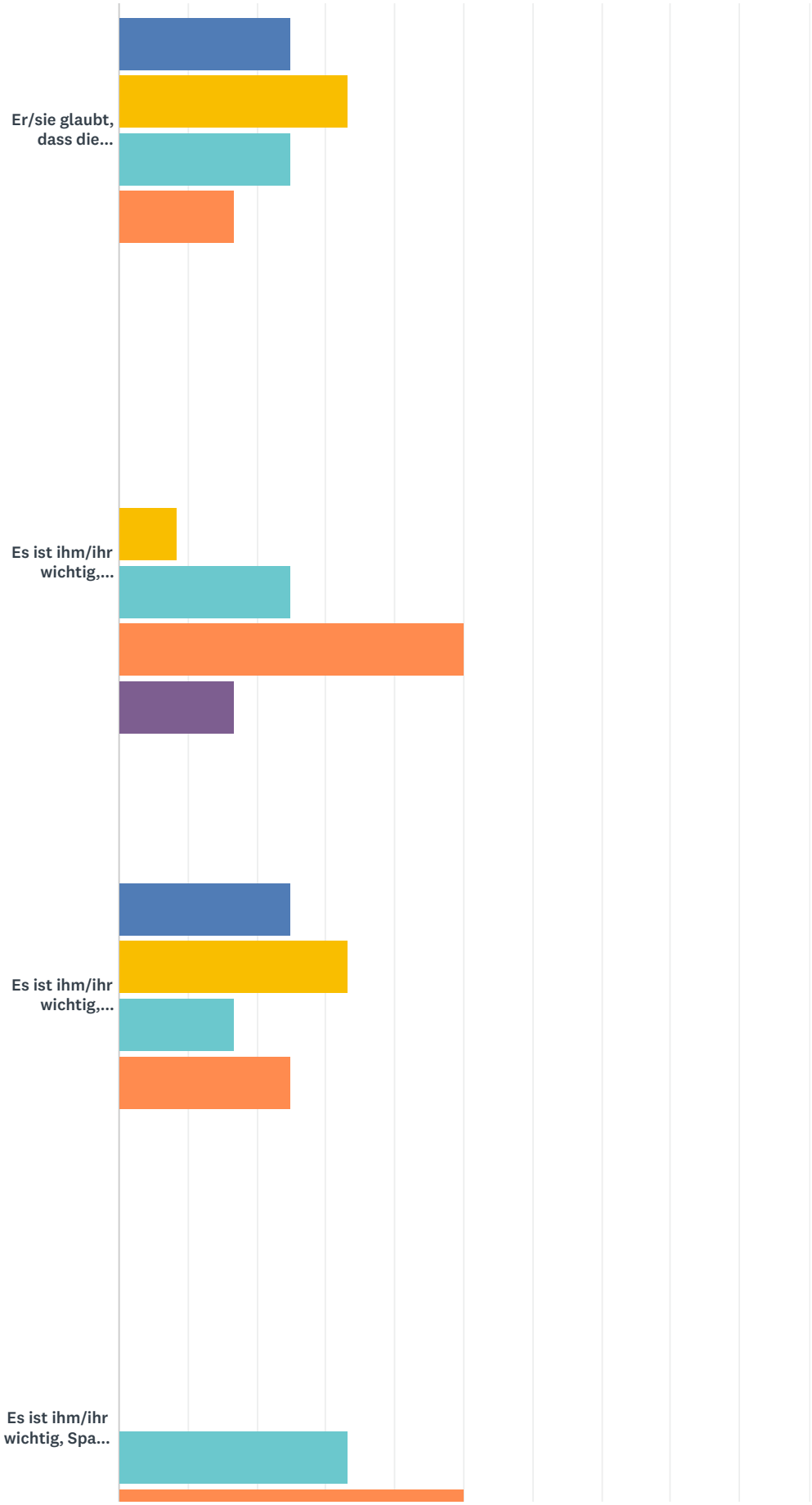
ANSWER CHOICES	RESPONSES	
18-25 Jahre	0.00%	0
26-45 Jahre	50.00%	9
46-65 Jahre	50.00%	9
66-75 Jahre	0.00%	0
> 75 Jahre	0.00%	0
TOTAL		18

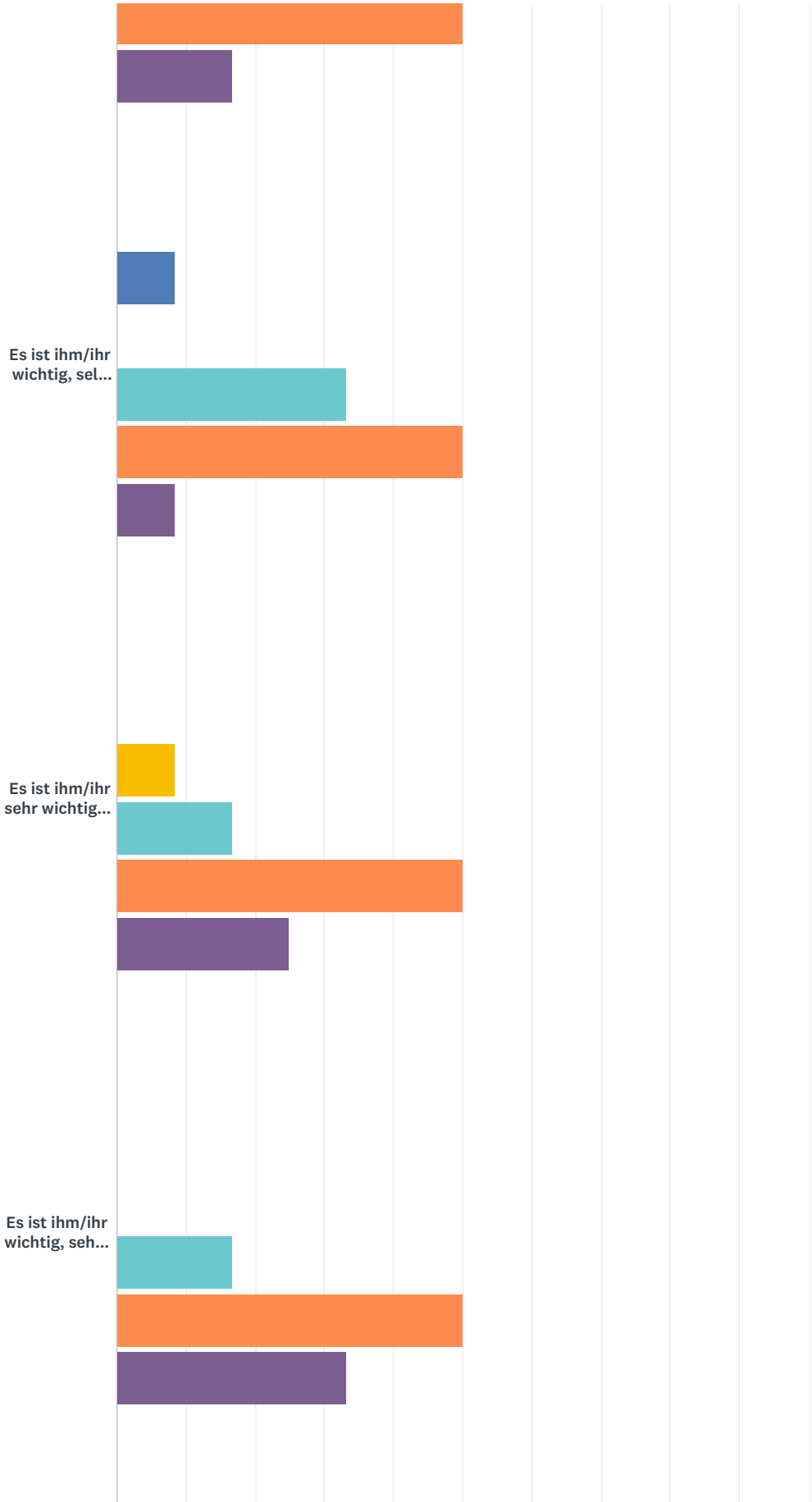
Q3 Im Folgenden werden Ziele, Erwartungen oder Wünsche von Personen beschrieben. Bitte gib an, in welchem Maße Dir die jeweilige Person ähnlich ist. Wenn Du weiblich bist, beziehe Dich bitte auf eine (imaginäre) weibliche Person, bei Männern auf eine männliche Person. Bitte versuche spontan und ohne lange Überlegungen zu antworten.

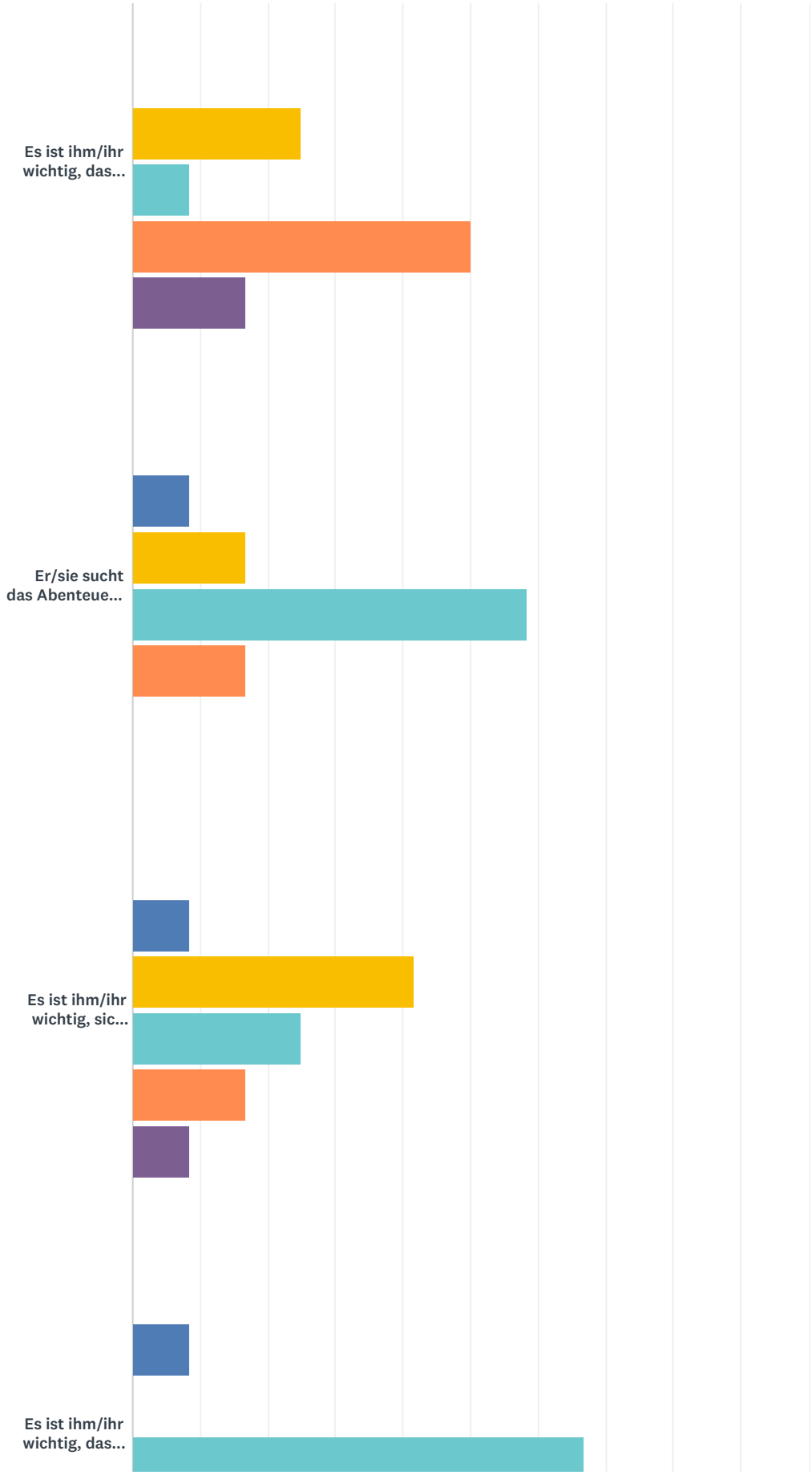
Answered: 12 Skipped: 6

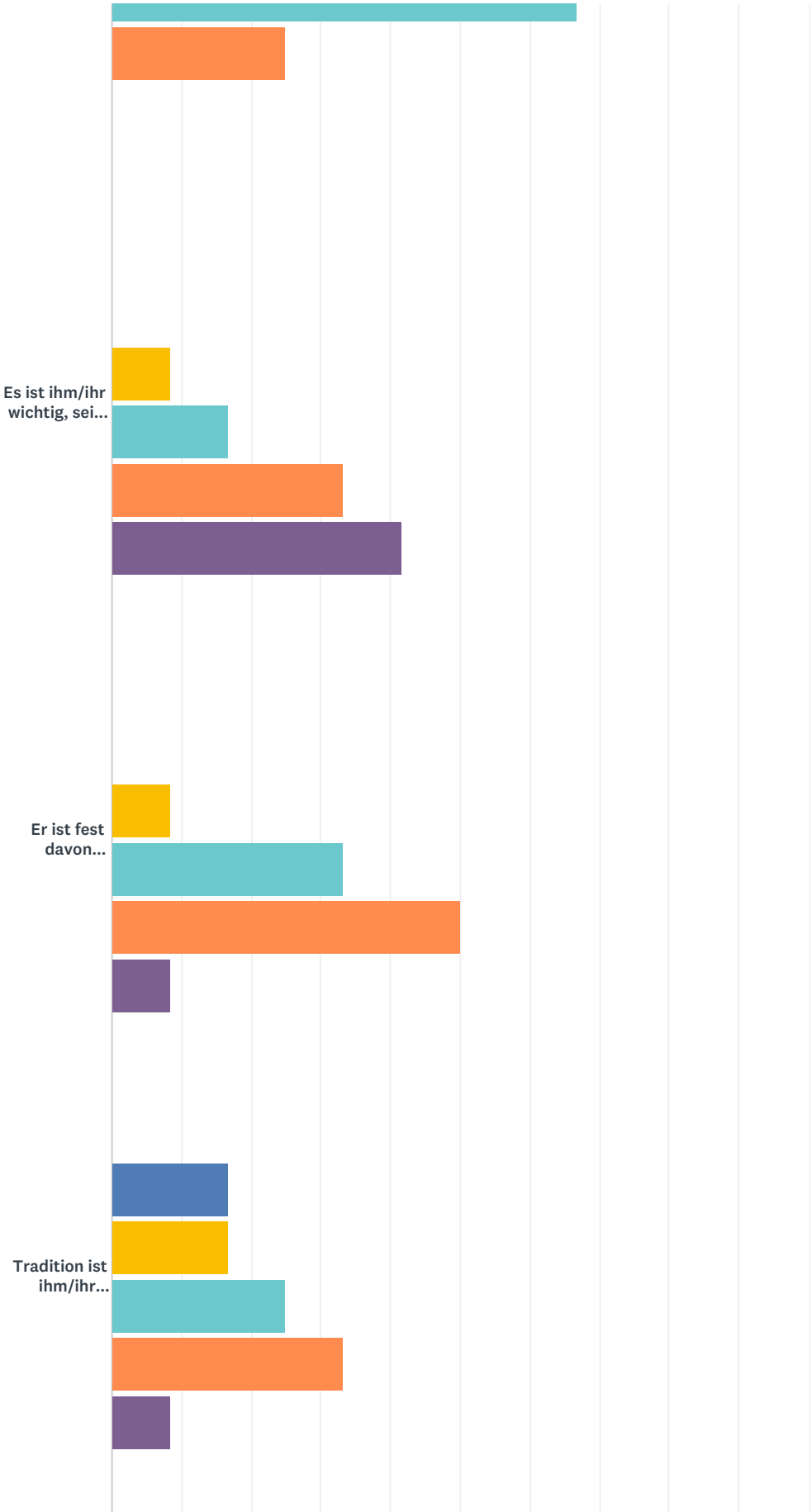


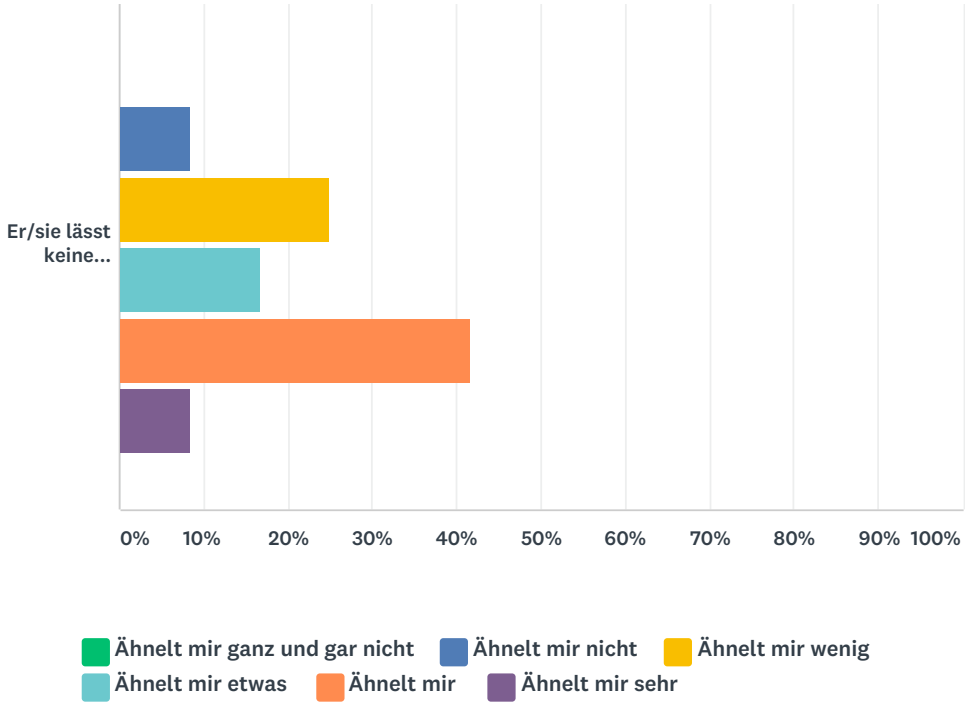

Es ist ihm/ihr wichtig,...
Es ist ihm/ihr wichtig, in...
Er/sie mag Überraschung...


Er/sie glaubt, dass die...
Es ist ihm/ihr wichtig,...
Es ist ihm/ihr wichtig,...
Es ist ihm/ihr wichtig, Spa...


Es ist ihm/ihr wichtig, sel...
Es ist ihm/ihr sehr wichtig...
Es ist ihm/ihr wichtig, seh...


Es ist ihm/ihr wichtig, das...
Er/sie sucht das Abenteue...
Es ist ihm/ihr wichtig, sic...
Es ist ihm/ihr wichtig, das...


Es ist ihm/ihr wichtig, sei...
Er ist fest davon...
Tradition ist ihm/ihr...



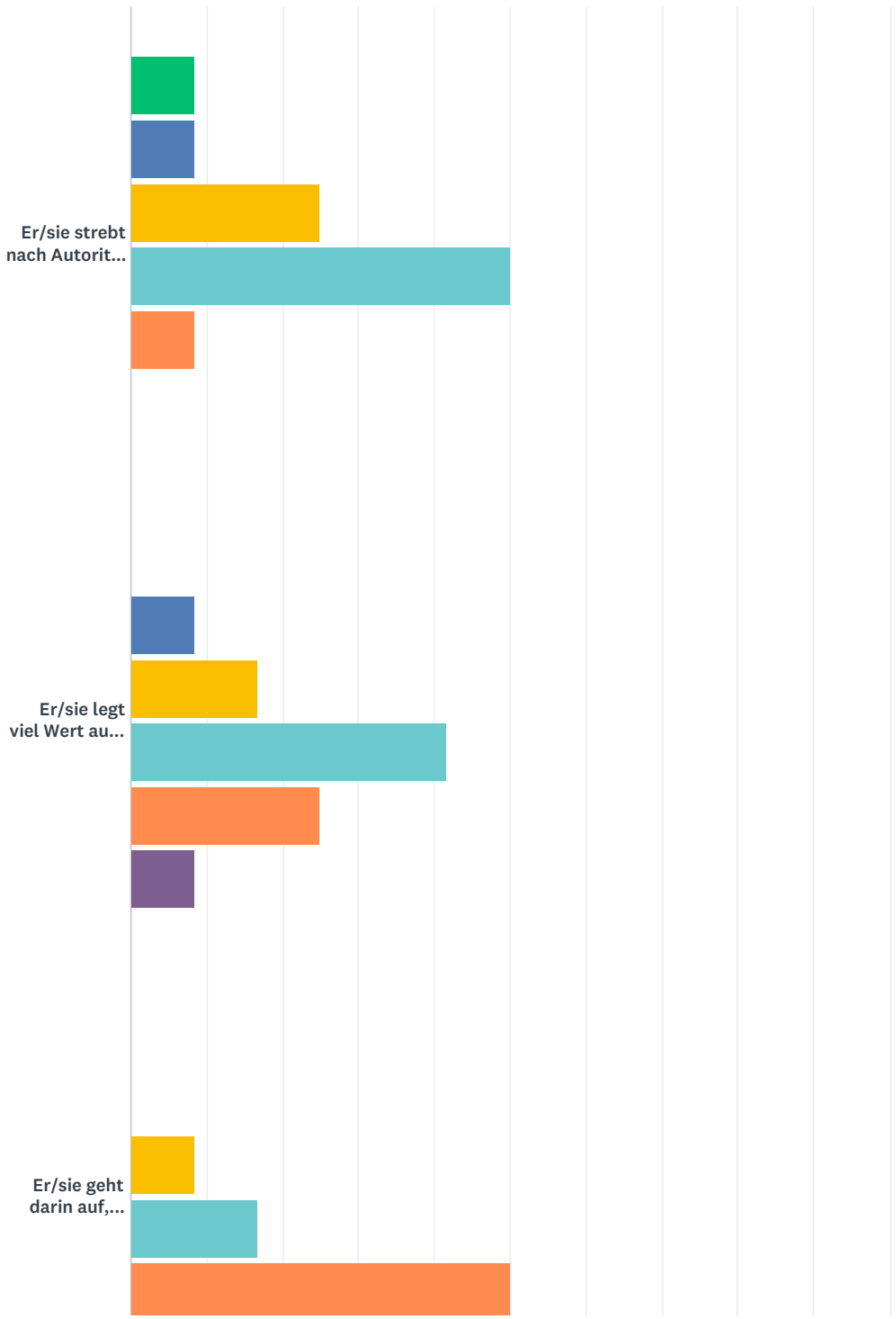
	ÄHNELT MIR GANZ UND GAR NICHT	ÄHNELT MIR NICHT	ÄHNELT MIR WENIG	ÄHNELT MIR ETWAS	ÄHNELT MIR	ÄHNELT MIR SEHR	TOTAL	WEIGHTED AVERAGE
Es ist ihm/ihr wichtig, neue Ideen zu entwickeln und kreativ zu sein. Er/sie unternimmt alles gerne auf seine/ihre eigene Art und Weise	8.33% 1	0.00% 0	0.00% 0	16.67% 2	41.67% 5	33.33% 4	12	4.83
Reichtum ist ihm/ihr wichtig. Er/sie möchte viel Geld und Luxusgüter besitzen	8.33% 1	25.00% 3	16.67% 2	41.67% 5	8.33% 1	0.00% 0	12	3.17
Für ihn/sie ist es wichtig, dass jeder Mensch auf dieser Welt gleich behandelt werden sollte. Er/sie glaubt, dass jeder Mensch die gleichen Chancen im Leben haben sollte.	8.33% 1	0.00% 0	0.00% 0	33.33% 4	58.33% 7	0.00% 0	12	4.33
Es ist ihm/ihr wichtig, seine/ihre Fähigkeiten unter Beweis zu stellen. Er/sie möchte, dass ihn/sie Leute für das bewundern, was er/sie tut.	0.00% 0	0.00% 0	0.00% 0	50.00% 6	41.67% 5	8.33% 1	12	4.58
Es ist ihm/ihr wichtig, in einer sicheren Umgebung zu leben. Er/sie vermeidet alles, das seine/ihre Sicherheit gefährden könnte.	0.00% 0	0.00% 0	0.00% 0	41.67% 5	50.00% 6	8.33% 1	12	4.67
Er/sie mag Überraschungen und hält immer Ausschau nach neuen Aktivitäten. Er/sie denkt, dass Abwechslung im Leben wichtig ist.	0.00% 0	0.00% 0	16.67% 2	50.00% 6	25.00% 3	8.33% 1	12	4.25
Er/sie glaubt, dass die Menschen tun sollten, was man Ihnen sagt. Er/sie denkt, dass Menschen sich immer an Regeln halten sollten, selbst dann, wenn es niemand sieht.	0.00% 0	25.00% 3	33.33% 4	25.00% 3	16.67% 2	0.00% 0	12	3.33

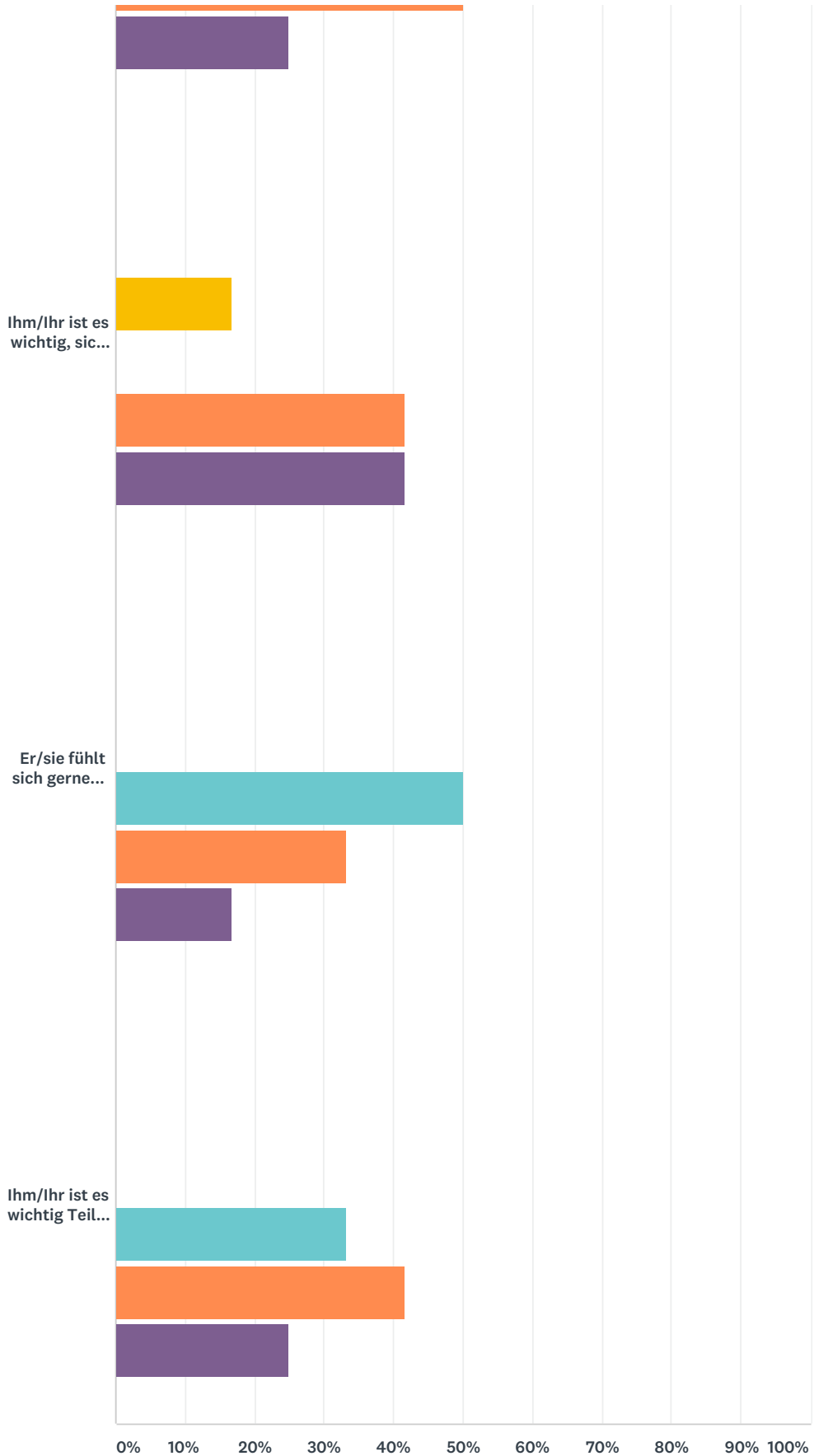
Es ist ihm/ihr wichtig, Menschen zuzuhören, die anders sind als er/sie. Auch wenn er/sie anderer Meinung ist als andere, will er/sie sie trotzdem verstehen.	0.00% 0	0.00% 0	8.33% 1	25.00% 3	50.00% 6	16.67% 2	12	4.75
Es ist ihm/ihr wichtig, zurückhaltend und bescheiden zu sein. Er/sie versucht, die Aufmerksamkeit nicht auf sich zu lenken.	0.00% 0	25.00% 3	33.33% 4	16.67% 2	25.00% 3	0.00% 0	12	3.42
Es ist ihm/ihr wichtig, Spaß zu haben. Er/sie gönnt sich selbst gerne etwas.	0.00% 0	0.00% 0	0.00% 0	33.33% 4	50.00% 6	16.67% 2	12	4.83
Es ist ihm/ihr wichtig, selbst zu entscheiden, was er tut. Er/sie ist gerne frei und unabhängig von anderen.	0.00% 0	8.33% 1	0.00% 0	33.33% 4	50.00% 6	8.33% 1	12	4.50
Es ist ihm/ihr sehr wichtig, den Menschen um ihn herum zu helfen. Er/sie will für deren Wohl sorgen.	0.00% 0	0.00% 0	8.33% 1	16.67% 2	50.00% 6	25.00% 3	12	4.92
Es ist ihm/ihr wichtig, sehr erfolgreich zu sein. Er/sie hofft, dass die Leute seine/ihre Leistungen anerkennen.	0.00% 0	0.00% 0	0.00% 0	16.67% 2	50.00% 6	33.33% 4	12	5.17
Es ist ihm/ihr wichtig, dass der Staat seine/ihre persönliche Sicherheit vor allen Bedrohungen gewährleistet. Er/sie will einen starken Staat, der seine Bürger verteidigt.	0.00% 0	0.00% 0	25.00% 3	8.33% 1	50.00% 6	16.67% 2	12	4.58
Er/sie sucht das Abenteuer und geht gerne Risiken ein. Er/sie will ein aufregendes Leben haben.	0.00% 0	8.33% 1	16.67% 2	58.33% 7	16.67% 2	0.00% 0	12	3.83
Es ist ihm/ihr wichtig, sich jederzeit korrekt zu verhalten. Er/sie vermeidet es, Dinge zu tun, die andere Leute für falsch halten könnten.	0.00% 0	8.33% 1	41.67% 5	25.00% 3	16.67% 2	8.33% 1	12	3.75
Es ist ihm/ihr wichtig, dass andere ihn/sie respektieren. Er/sie will, dass die Leute tun, was er/sie sagt.	0.00% 0	8.33% 1	0.00% 0	66.67% 8	25.00% 3	0.00% 0	12	4.08
Es ist ihm/ihr wichtig, seinen Freunden gegenüber loyal zu sein. Er will sich für Menschen einsetzen, die ihm/ihr nahestehen.	0.00% 0	0.00% 0	8.33% 1	16.67% 2	33.33% 4	41.67% 5	12	5.08
Er ist fest davon überzeugt, dass die Menschen sich um die Natur kümmern sollten. Umweltschutz ist ihm/ihr wichtig.	0.00% 0	0.00% 0	8.33% 1	33.33% 4	50.00% 6	8.33% 1	12	4.58
Tradition ist ihm/ihr wichtig. Er/sie versucht, sich an die Sitten und Gebräuche zu halten, die ihm/ihr von seiner/ihrer Religion oder seiner/ihrer Familie überliefert wurden.	0.00% 0	16.67% 2	16.67% 2	25.00% 3	33.33% 4	8.33% 1	12	4.00

Er/sie lässt keine Gelegenheit aus, Spaß zu haben. Es ist ihm/ihr wichtig, Dinge zu tun, die ihm/ihr Vergnügen bereiten.	0.00% 0	8.33% 1	25.00% 3	16.67% 2	41.67% 5	8.33% 1	12	4.17

Q4 Im Folgenden werden berufliche Motivationen von Personen beschrieben. Bitte gib an, in welchem Maße Dir die jeweilige Person ähnlich ist. Wenn Du weiblich bist, beziehe Dich bitte auf eine (imaginäre) weibliche Person, bei Männern auf eine männliche Person. Bitte versuche spontan und ohne lange Überlegungen zu antworten.

Answered: 12 Skipped: 6



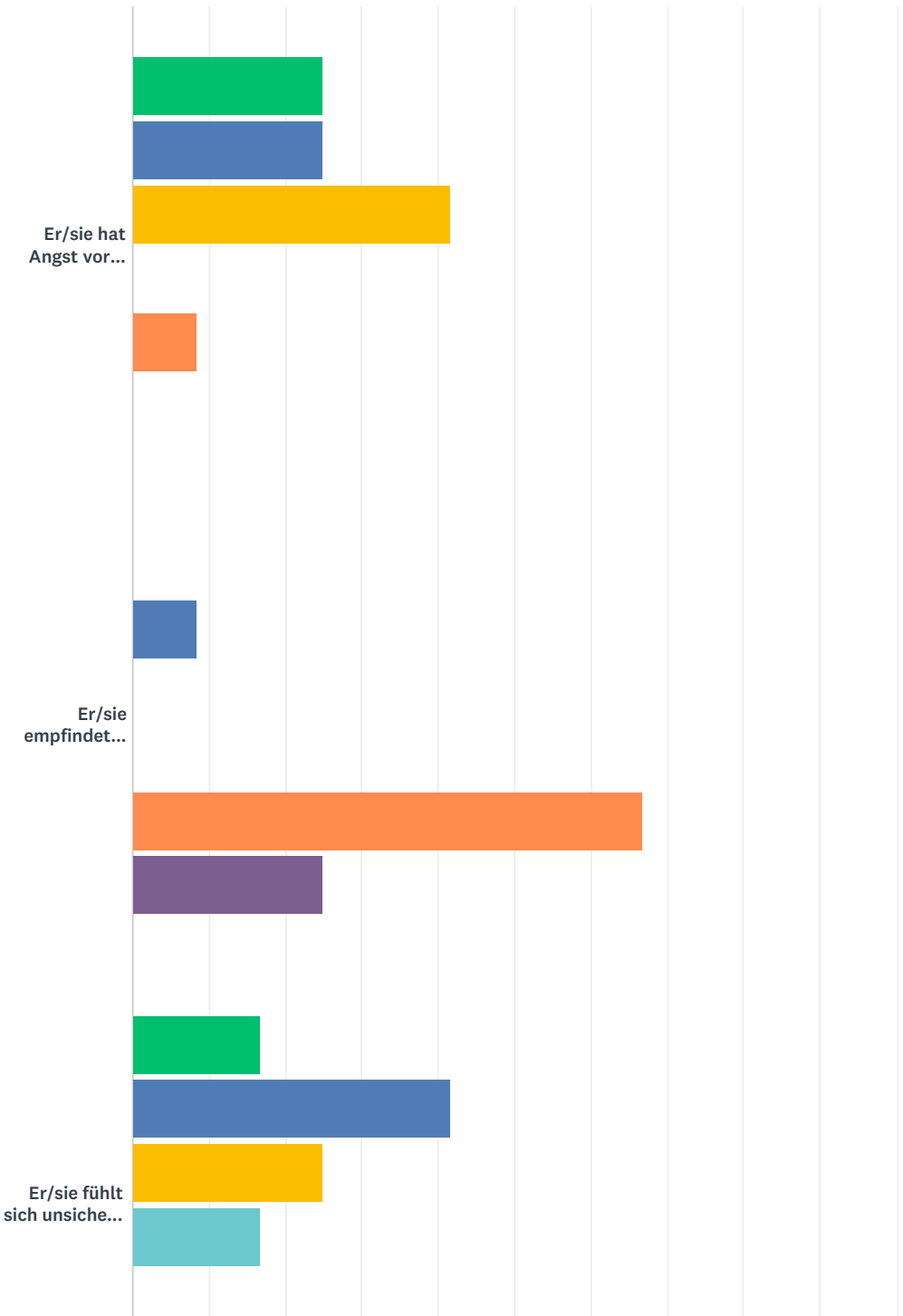

Ihm/Ihr ist es wichtig, sic...
Er/sie fühlt sich gerne...
Ihm/Ihr ist es wichtig Teil...
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%

Masterarbeit zum Thema "Mitarbeiteranforderungen an den Dienstreiseprozess"

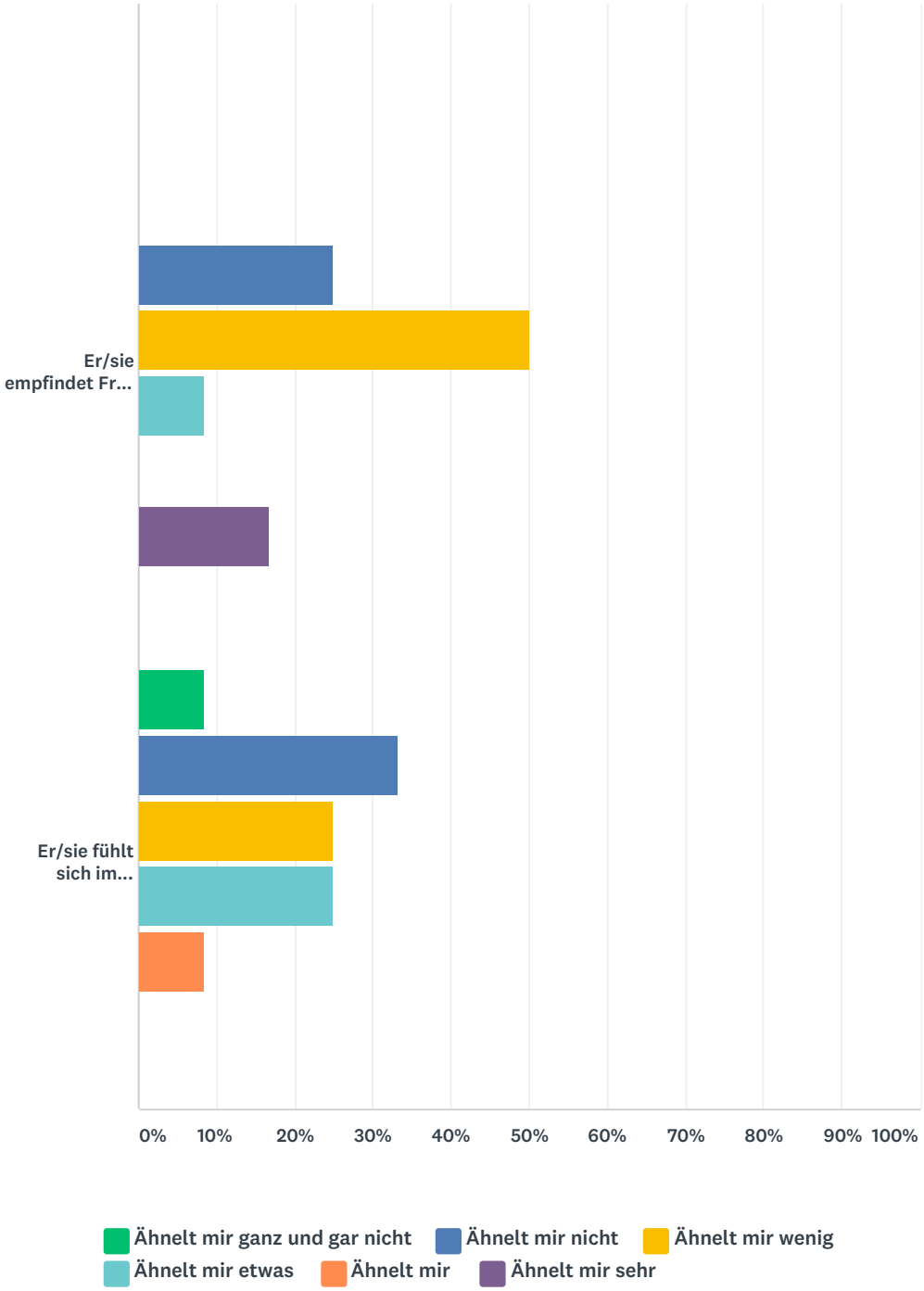
	ÄHNELT MIR GANZ UND GAR NICHT	ÄHNELT MIR NICHT	ÄHNELT MIR WENIG	ÄHNELT MIR ETWAS	ÄHNELT MIR	ÄHNELT MIR SEHR	TOTAL	WEIGHTED AVERAGE
Er/sie strebt nach Autorität und mag es andere zu delegieren.	8.33% 1	8.33% 1	25.00% 3	50.00% 6	8.33% 1	0.00% 0	12	3.42
Er/sie legt viel Wert auf einen eigenen Firmenwagen und gehobene Standards (z.B. Hotel) auf Dienstreisen.	0.00% 0	8.33% 1	16.67% 2	41.67% 5	25.00% 3	8.33% 1	12	4.08
Er/sie geht darin auf, eigene Ideen und Konzepte im beruflichen Alltag beizusteuern	0.00% 0	0.00% 0	8.33% 1	16.67% 2	50.00% 6	25.00% 3	12	4.92
Ihm/Ihr ist es wichtig, sich mit seinem/ihrem Job und dessen Aufgaben zu identifizieren	0.00% 0	0.00% 0	16.67% 2	0.00% 0	41.67% 5	41.67% 5	12	5.08
Er/sie fühlt sich gerne durch andere bestätigt und braucht Kontakt zu anderen Mitarbeitern	0.00% 0	0.00% 0	0.00% 0	50.00% 6	33.33% 4	16.67% 2	12	4.67
Ihm/Ihr ist es wichtig Teil eines Teams mit gemeinsamen Zielen und Verantwortungen zu sein	0.00% 0	0.00% 0	0.00% 0	33.33% 4	41.67% 5	25.00% 3	12	4.92

Q5 Im Folgenden werden Emotionen von Personen beschrieben. Bitte gib an, in welchem Maße Dir die jeweilige Person ähnlich ist. Wenn Du weiblich bist, beziehe Dich bitte auf eine (imaginäre) weibliche Person, bei Männern auf eine männliche Person. Bitte versuche spontan und ohne lange Überlegungen zu antworten.

Answered: 12 Skipped: 6



Masterarbeit zum Thema "Mitarbeiteranforderungen an den Dienstreiseprozess"



	ÄHNELT MIR GANZ UND GAR NICHT	ÄHNELT MIR NICHT	ÄHNELT MIR WENIG	ÄHNELT MIR ETWAS	ÄHNELT MIR	ÄHNELT MIR SEHR	TOTAL	WEIGHTED AVERAGE
Er/sie hat Angst vor Veränderungen oder neuen Prozessen im beruflichen Alltag	25.00% 3	25.00% 3	41.67% 5	0.00% 0	8.33% 1	0.00% 0	12	2.42
Er/sie empfindet Freude, wenn ein berufliches Ziel erfüllt wird	0.00% 0	8.33% 1	0.00% 0	0.00% 0	66.67% 8	25.00% 3	12	5.00
Er/sie fühlt sich unsicher im Umgang mit dem aktuellen Dienstreiseprozess	16.67% 2	41.67% 5	25.00% 3	16.67% 2	0.00% 0	0.00% 0	12	2.42

Er/sie empfindet Frust im Umgang mit dem aktuellen Dienstreiseprozess	0.00% 0	25.00% 3	50.00% 6	8.33% 1	0.00% 0	16.67% 2	12	3.33
Er/sie fühlt sich im beruflichen Alltag alleingelassen	8.33% 1	33.33% 4	25.00% 3	25.00% 3	8.33% 1	0.00% 0	12	2.92

Q6 Deine Anforderungen an die "Planung der Dienstreise"

Answered: 11 Skipped: 7

#	RESPONSES	DATE
1	Ich wünsche mir mehr Unterstützung durch eine Assistenz die, die Buchungen vornimmt	12/3/2019 10:49 AM
2	Unkompliziert	12/2/2019 7:27 AM
3	-	11/29/2019 3:04 PM
4	Ich wünsche mir zu erkennen welcher meiner Kollegen im selben Hotel oder der Nähe sich befindet. Des weiteren einen optimale Routenplanung mit Berücksichtigung der aktuellen Verkehrslage (bessere Navigationssysteme ähnlich Google Maps)	11/29/2019 10:51 AM
5	x	11/29/2019 9:05 AM
6	Ich muss flexibel sein, damit ich auf die Wünsche meiner Kunden eingehen kann.	11/28/2019 12:59 PM
7	Ich will meine Dienstreise selbständig und flexibel gestalten	11/26/2019 9:09 PM
8	Einfach, schnell (nicht bei Concur gegeben bzgl. Buchung Flug, Zug und Mietwagen!)	11/26/2019 4:20 PM
9	Ich wünsche mir, dass ich individueller planen kann Ich wäre gerne in der Lage, meine Reisekostenabrechnung schneller zu erstellen	11/26/2019 2:29 PM
10	Ich wünsche mir die Planung mobil und spontan zu jeder Zeit vornehmen zu können.	11/26/2019 1:41 PM
11	Rechtzeitig muß vorab geklärt werden, wann und wo ich den Termin haben werde. Kurz gesagt, ich brauche vorab Planungssicherheit.	11/26/2019 11:24 AM

Q7 Deine Anforderungen an die "Anreise/Abreise"

Answered: 11 Skipped: 7

#	RESPONSES	DATE
1	Ich erwarte, dass in dem Hotel bereits die Firmen Adresse für die Rechnung hinterlegt ist	12/3/2019 10:49 AM
2	Zuverlässig	12/2/2019 7:27 AM
3	-	11/29/2019 3:04 PM
4	Bessere Erkennung und Information über die Verkehrslage. Aktuell fest eingebaute Navigationssysteme sind hier nicht gut aufgestellt. Auch die Verbindung über CarNet ist nicht gut gelöst da die Navigation immer abgebrochen werden muss wenn man das Display für andere Funktionen (Telefonieren) benötigt.	11/29/2019 10:51 AM
5	x	11/29/2019 9:05 AM
6	flexibel	11/28/2019 12:59 PM
7	Flexibel ohne Bindung an die Art und Weise des Reisens. Um auf geänderte Termine schnell reagieren zu können	11/26/2019 9:09 PM
8	in time, zügig, bequem, ausgeruht	11/26/2019 4:20 PM
9	Ich wünsche mir eine freie Wahl der Anreise, mit welchem Fahrzeug ich anreise	11/26/2019 2:29 PM
10	keine besonderen Anforderungen	11/26/2019 1:41 PM
11	Da ich selber alles alleine planen muss, muss ich mich selber darum kümmern. Das ist sehr zeitaufwendig.	11/26/2019 11:24 AM

Q8 Deine Anforderungen "Während der Dienstreise (beim Kunden oder Event)"

Answered: 11 Skipped: 7

#	RESPONSES	DATE
1	Keine	12/3/2019 10:49 AM
2	Ich wünsche mir, dass man genug Zeit hat sich mit dem Kunden zu beschäftigen.	12/2/2019 7:27 AM
3	-	11/29/2019 3:04 PM
4	Einfache Buchen eines Hotelzimmers	11/29/2019 10:51 AM
5	x	11/29/2019 9:05 AM
6	Ich muss Zeit haben und nicht unter Stress stehen, damit ich mich auf die Kunden/das Event konzentrieren kann.	11/28/2019 12:59 PM
7	Selbständig und flexibel ohne Einschränkungen	11/26/2019 9:09 PM
8	effektiv	11/26/2019 4:20 PM
9	Ich wünsche mir einfachere Rechnungslegung beim Essen mit Kunden	11/26/2019 2:29 PM
10	keine besonderen Anforderungen	11/26/2019 1:41 PM
11	Bei guter Vorbereitung ist der Ablauf reibungslos. Aber wie gesagt, ich muss mich selber kümmern, da mir Keiner diese Arbeit abnimmt.	11/26/2019 11:24 AM

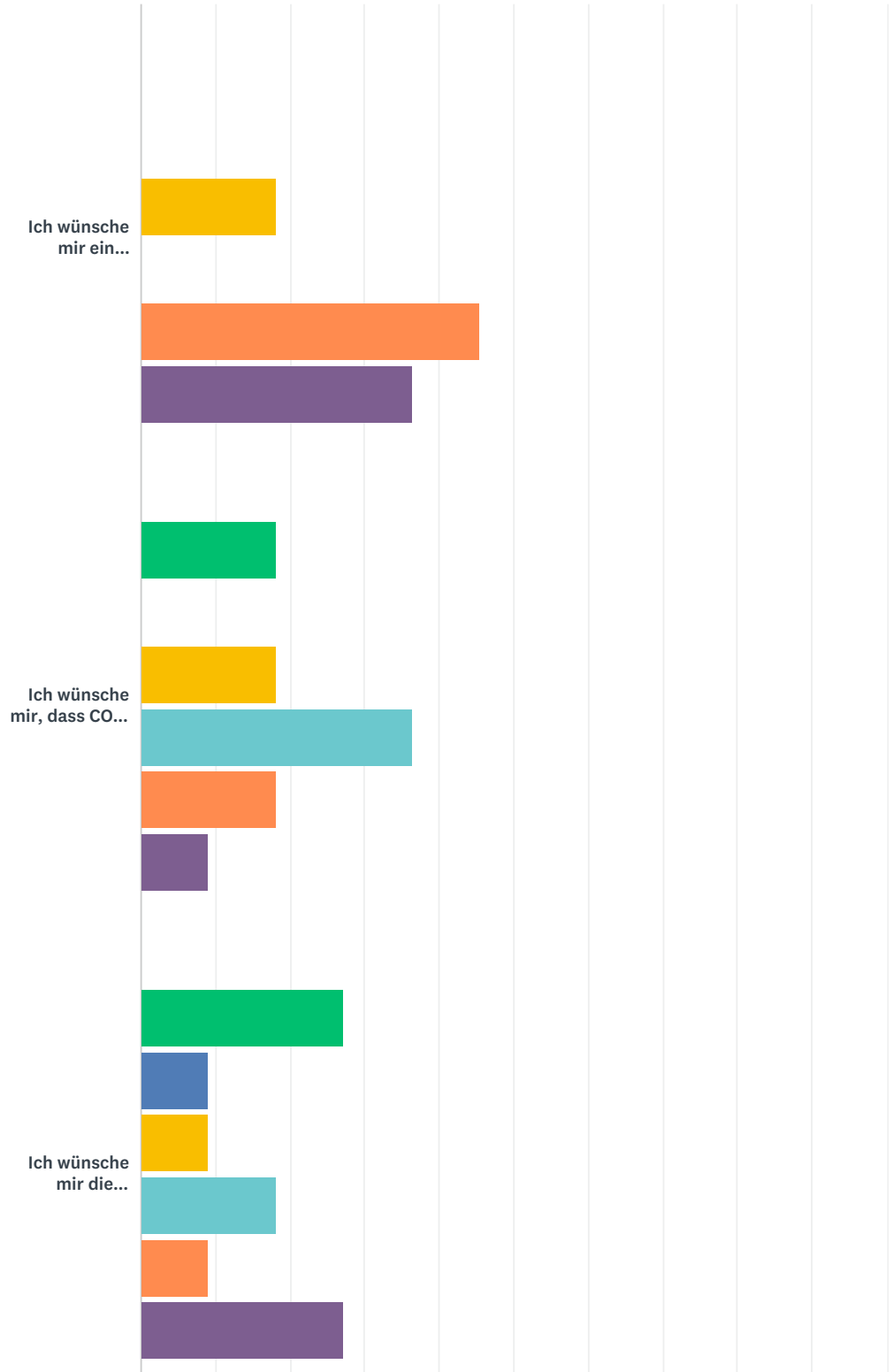
Q9 Deine Anforderungen zur "Nachbereitung der Dienstreise"

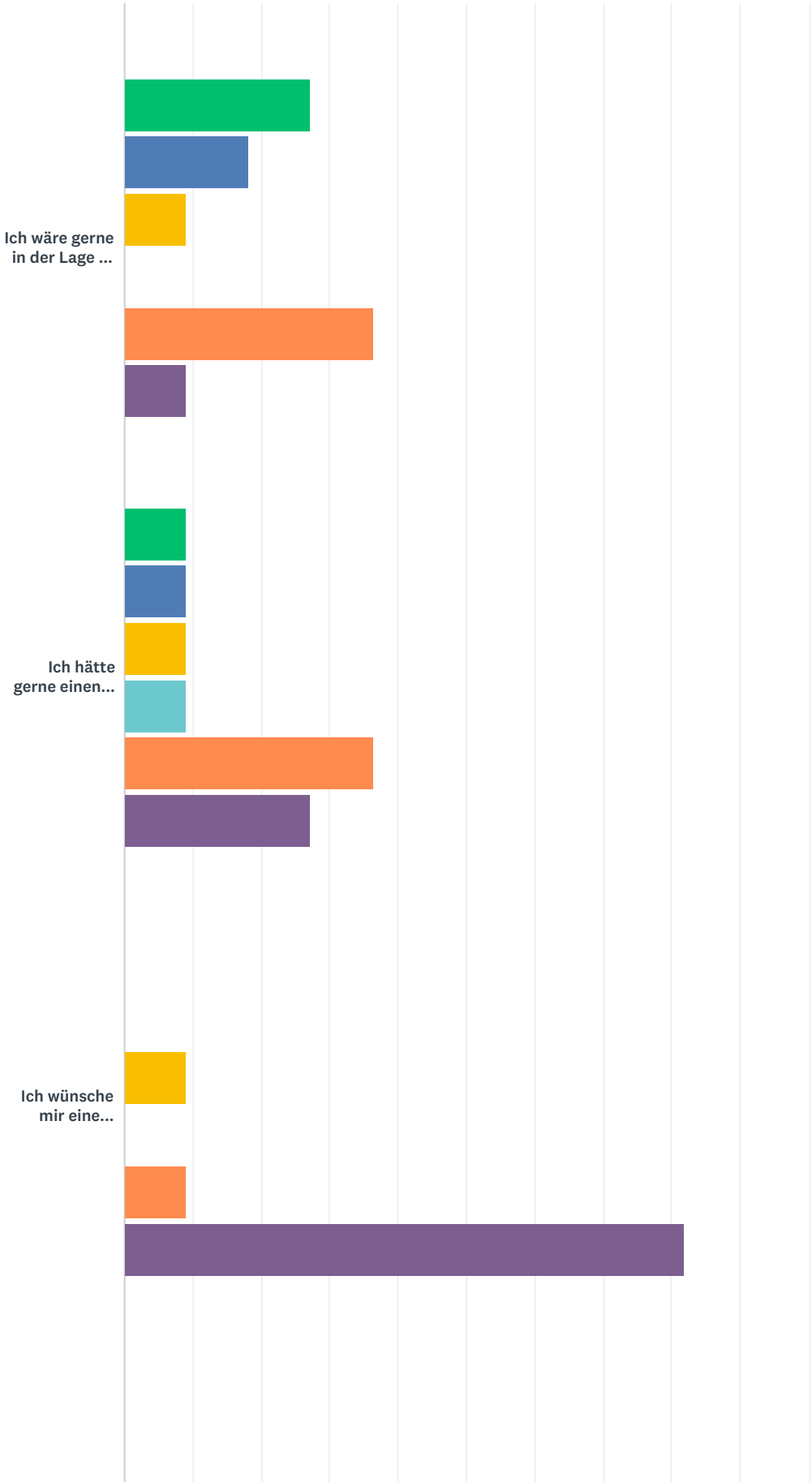
Answered: 11 Skipped: 7

#	RESPONSES	DATE
1	Ich wünsche mir, dass die Reisekostenabrechnung mittels einer Team-Assistenz durchgeführt wird und nicht von jedem einzelnen Kollegen. Viel Effizienter, denn es braucht sich nicht jeder wieder neu ins System einzudenken	12/3/2019 10:49 AM
2	ich wünsche mir, dass Dokumentationen einfach, schnell und übersichtlich gestaltet werden können.	12/2/2019 7:27 AM
3	-	11/29/2019 3:04 PM
4	Einfache Tools für das Eintragen von Terminen, Rechnungen, Besuchsberichten etc.	11/29/2019 10:51 AM
5	x	11/29/2019 9:05 AM
6	Zeit.	11/28/2019 12:59 PM
7	Möglichst wenig manuell smart	11/26/2019 9:09 PM
8	einfache Abrechnung (bei Concur gegeben, wenn man damit klar kommt)	11/26/2019 4:20 PM
9	Ich wünsche mir ein einfacheres Reisekostentool	11/26/2019 2:29 PM
10	Abwicklung der Reisekosten mobil und ohne viel Aufwand.	11/26/2019 1:41 PM
11	Auch hier muss ich mich selber kümmern. Hier bräuchte ich Entlastung.	11/26/2019 11:24 AM

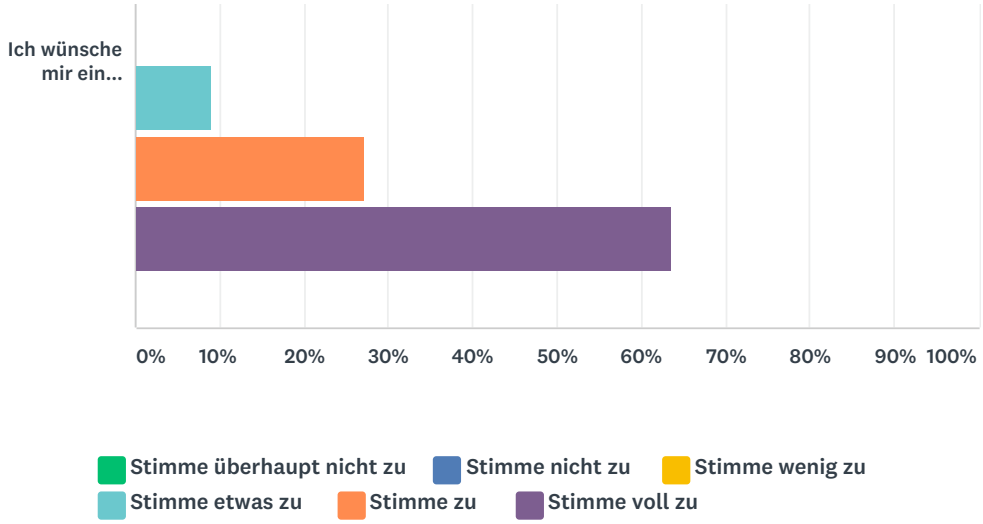
Q10 Deine Kollegen und Kolleginnen haben in besagtem Workshop bereits einige Anforderungen an den Dienstreiseprozess formuliert. Inwieweit stimmst du den folgenden Anforderungen zu?

Answered: 11 Skipped: 7




Ich wäre gerne in der Lage ...
Ich hätte gerne einen...
Ich wünsche mir eine...

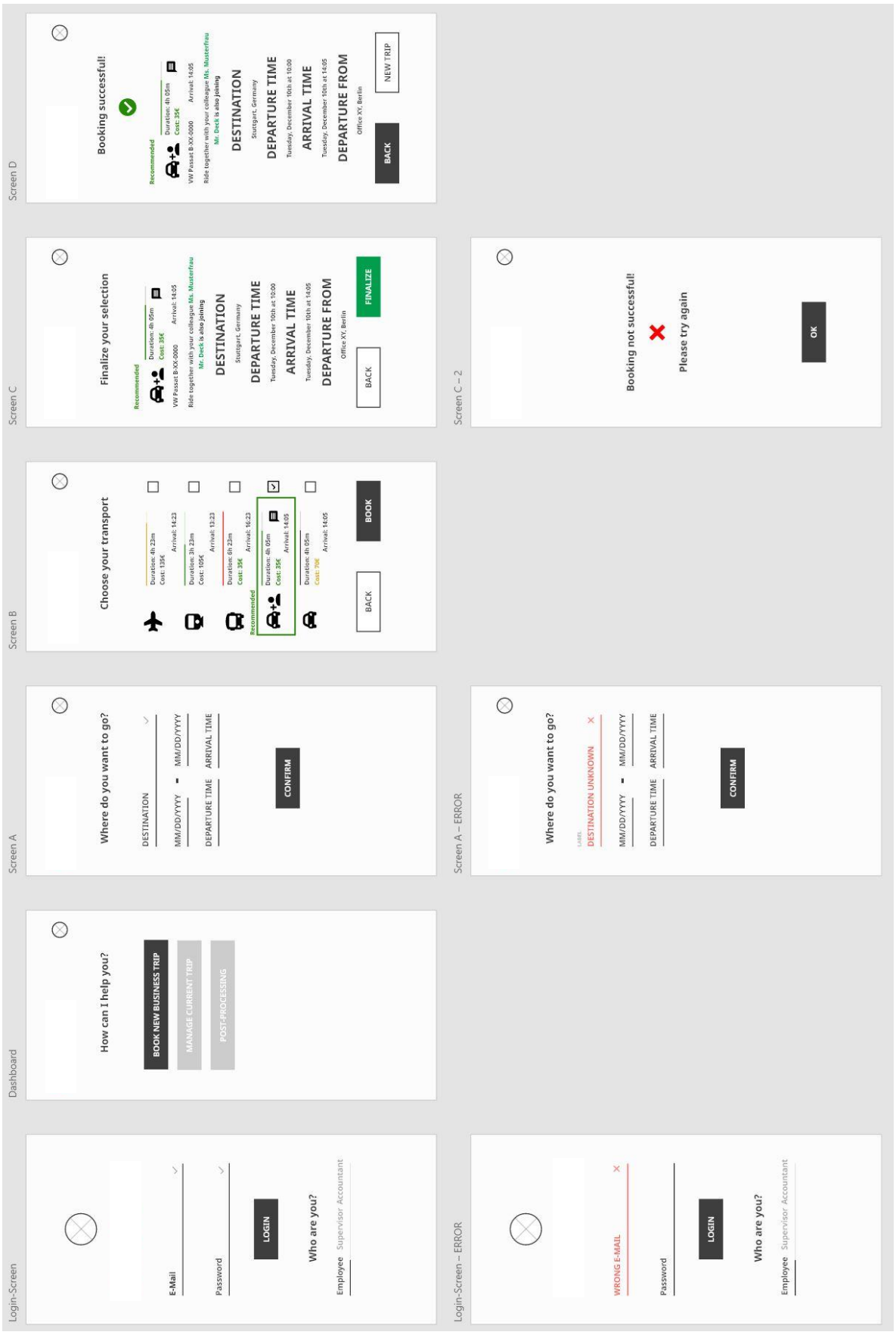
Masterarbeit zum Thema "Mitarbeiteranforderungen an den Dienstreiseprozess"



	STIMME ÜBERHAUPT NICHT ZU	STIMME NICHT ZU	STIMME WENIG ZU	STIMME ETWAS ZU	STIMME ZU	STIMME VOLL ZU	TOTAL	WEIGHTED AVERAGE
Ich wünsche mir ein einfaches, smartes Buchungstool, dass mir alternative Reisemöglichkeiten, inklusive Reisedauer anzeigt.	0.00% 0	0.00% 0	18.18% 2	0.00% 0	45.45% 5	36.36% 4	11	5.00
Ich wünsche mir, dass CO2 Reduktion im Vordergrund der Dienstreise steht und nachhaltiges Verhalten von SE incentiviert wird.	18.18% 2	0.00% 0	18.18% 2	36.36% 4	18.18% 2	9.09% 1	11	3.64
Ich wünsche mir die Integration moderner Mobilitätskonzepte, wie z.B. Car-Pooling, Car-Sharing oder Mitfahrgelegenheiten.	27.27% 3	9.09% 1	9.09% 1	18.18% 2	9.09% 1	27.27% 3	11	3.55
Ich wäre gerne in der Lage zu sehen, welche Mitarbeiter sich gerade in der Nähe meines Ortes/Hotels/Messe aufhalten.	27.27% 3	18.18% 2	9.09% 1	0.00% 0	36.36% 4	9.09% 1	11	3.27
Ich hätte gerne einen digitalen Assistenten, der mich über die nötigen Schritte der Dienstreise informiert und mich bei Fragen oder notwendigen Planänderungen unterstützt.	9.09% 1	9.09% 1	9.09% 1	9.09% 1	36.36% 4	27.27% 3	11	4.36
Ich wünsche mir eine einheitliche Zutrittskontrolle für verschiedene Standorte von SE	0.00% 0	0.00% 0	9.09% 1	0.00% 0	9.09% 1	81.82% 9	11	5.64
Ich wünsche mir ein einfaches, smartes Abrechnungs-Tool, dass so wenig manuelle Eingaben wie möglich erfordert.	0.00% 0	0.00% 0	0.00% 0	9.09% 1	27.27% 3	63.64% 7	11	5.55

Annexure 4: Mockups

Mockup R1



Mockup R2


Login-Screen
Dashboard
Screen E
Screen F
Screen G
Screen H
Screen I
Screen F – 1
Screen J
Screen K
Login-Screen – ERROR
Screen G – 1
Screen H – 1
Screen J – 1
How can I help you?
BOOK NEW BUSINESS TRIP
MANAGE CURRENT TRIP
POST-PROCESSING
Select which trip to post-process
BUSINESS TRIP A
BUSINESS TRIP B
CONTINUE
Business Trip A
Receipts
Expenses
No Receipts added
SCAN DOCUMENTS
CONCLUDE POST-PROCESSING
BACK
Scan or Upload Documents
Select Category
Click here to take one or multiple pictures
Upload from Camera Roll
CONFIRM
Hosting Slip A
Hosting Slip B
Purpose
Dinner with Customer
Date
December 3rd, 2019
Location
Munich, Germany
Restaurant
Restaurant Bo GmbH
Host
Mr. Benedict
Bill Number
2019 - Q2 - 03 - 0123
Net Cost
26.58€
TIP
3.42€
Tax Rate
7.00%
Sales Tax
1.86€
FINALIZE
Hosting Slip A added successfully!
ADD DOCUMENTS
OK
Are you sure you want to conclude Post Processing?
Please make sure that all your information is correct.
Your Supervisor will be informed
SEND FOR REVIEW
Your Post-Processing for Business Trip A has been sent for review
WRONG E-MAIL
E-Mail
Password
LOGIN
Who are you?
Employee
Supervisor
Accountant