Version: 1.0

Universiteit Utrecht

The customer is always right: Enabling customer journeys for enterprise architecture

MBI Graduation Project

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Date: 12th of September 2018

Acknowledgements

This master thesis about the contextual customer journey process is the final step of my master of Business Informatics. Over the past two years, this study gave me the opportunity to increase my knowledge about information science and scientific research at Utrecht University. It was a great experience to apply the learned theory in practice at a Dutch banking business.

I would like to thank Marcela Ruiz for guiding me during my master thesis. She gave me the opportunity to get into contact with the Dutch banking business and she guided me through the whole process with weekly meetings (with valuable discussions) and feedback/input for the realised documentation in this project. I also want to thank Jan Martijn van der Werf for providing feedback and input for this project.

I would like to thank my supervisors Rob Douwes for the overall supervision, weekly meetings and valuable feedback. Hans Spaander and Sybren ten Hartog for the daily supervision and valuable feedback/tips during the realisation of the master thesis. I also want to thank all of my colleagues of the distribution team for their tips, discussions and input during the weekly meetings.

Last I want to thank my friends and family for their support during the realisation of my master thesis. I could not have finalised it without them.

Alexander Bestebreurtje
Nieuwegein, September 2018

Abstract

Analysing customer journeys provide organisations means to better understand the expectations of their customers, and to create an optimal customer experience. Academic and industrial evidences show that when the customer journey supports contextual aspects, the chances that a customer buys a certain product they used before increases. Some strategies to improve the customer journey includes process mining and customer experience mapping. These strategies improve customer journeys by comparing the expected customer journey with how the customer is actually experiences the customer journey. Nevertheless, none of the previous strategies provides support to align contextual aspects that support the customer journey or align the customer journey with elements in the enterprise architecture. In this study, we design a process to support contextual aspects in a customer journey and support alignment with the enterprise architecture: The contextual customer journey process. The process supports enterprise architects when aligning customer journey with the contextual aspects and the enterprise architecture. This enables the process of the customer journey and realises context-awareness of the customer. To validate the contextual customer journey process, we analysed a use case at a Dutch banking business and we held a focus group to evaluate the process and the application of the use case in terms of stakeholders' perceptions. The focus group has shown that the contextual customer journey process is a structured and logical approach, which gives a quick overview of the changes when including a new contextual aspect in a customer journey.

Keywords: Customer Journey, Application Architecture, Contextual aspects, Multilingual context, Enterprise Architecture

Table of Contents

1. Introduction 6
1.1. Motivation 6
1.2. Objectives 7
1.3. Research Approach 8
2. Literature review 10
2.1. Customer journey 10
2.2. Context 12
2.3. Application architecture 13
2.4. Alignment Customer journey and Context 14
2.5. Alignment Customer journey and enterprise architecture 15
2.6. Alignment Context and enterprise architecture 17
2.7. Conceptual framework 18
2.8. Main findings and discussion 18
3. The Contextual customer journey process 22
3.1. The requirements 22
3.2. Description of the process 23
3.3. Running example (web shop) 28
3.4. User experience to the customer journey 29
3.5. Guidelines to go from the customer journey to the enterprise architecture 30
3.6. Context based customer journey 38
3.7. Traceability/impact management Technique 42
3.8. Summary 51
4. Treatment Validation 52
4.1. Research method 53
4.2. The ContextBank case and the unit of analysis 55
4.3. Methods for data collection 56
4.4. Procedure 58
4.5. Validity and ethical issues 60
4.6. Results 62
4.7. Discussion 66
4.8. Summary 74
5. Conclusion 75
5.1. Limitations 76
5.2. Future work 76
6. References 79
Appendix A: Use case 82
Appendix B: Questionnaire 97
Appendix C: Results MEM-questionnaire 99
Appendix D: Architecture guidelines 101
Appendix E: Contextual need guidelines 103
Appendix F: Colour traceability guidelines 105
Appendix G: Paper 108

Table of figures

Figure 1 Process mining framework (Bernard & Andritsos, 2017) 6
Figure 2 Elements customer Journey mapping (Bernard & Andritsos, 2017) 6
Figure 3 Design Science Cycle (Wieringa, 2014) 9
Figure 4 Service blueprinting 15
Figure 5 Business process to application architecture alignment 16
Figure 6 The conceptual framework 18
Figure 7 Method notion 23
Figure 8 Contextual customer journey framework 24
Figure 9 Contextual customer journey process map 25
Figure 10 Journey touchpoints web shop 28
Figure 11 Persona running example 29
Figure 12 Running example Event logs in touchpoint 30
Figure 13 Mapping layers 30
Figure 14 Linking the Customer journey to the Business service layer 32
Figure 15 Steps from business service layer to business process layer 34
Figure 16 Steps from business process layer to application services layer 34
Figure 17 Steps from application services layer to application components layer 35
Figure 18 Running example touchpoints to business service 36
Figure 19 Running example business service to business process 37
Figure 20 Running example business process to application service 37
Figure 21 Running example from application services to application components 38
Figure 22 Update persona, including traceability 40
Figure 23 Running example Persona 42
Figure 24 Running example Event log business process changes 46
Figure 25 Running example Event log application services changes 46
Figure 26 Running example Event log application components changes 47
Figure 27 Running example traceability contextual need touchpoints 48
Figure 28 Running example Context business service 48
Figure 29 Running example Context business process 49
Figure 30 Running example Context application services 50
Figure 31 Running example Context application components 51
Figure 32 Overview of the technical action research methodology, which is used for the validation of the contextual customer journey process in the ContextBank use case 53
Figure 33 Method Evaluation Model (Moody, 2003) 54
Figure 34 GQM model 55
Figure 35 Design of the single holistic case study for the ContextBank use case 56
Figure 36 Procedure for data collection 58
Figure 37 Node tree taxonomy NVIVO 63
Figure 38 Explicit tagging of the recording in NVIVO 63
Figure 39 Focus group Stakeholders writing down post-its while performing in the focus groups 65
Figure 40 Application of the conceptual framework to the use case from the banking sector 83
Figure 41 Customer journey: Registration 83
Figure 42 Affected touchpoints event logs use case 84
Figure 43 Persona ContextBank 84
Figure 44 Touchpoint to business service use case 85
Figure 45 business service to business process use case 86
Figure 46 business process to application services use case 86
Figure 47 Application services to application components use case 87
Figure 48 changes business service layer AS-IS use case 88
Figure 49 changes business process layer AS-IS use case 89
Figure 50 Application services layer AS-IS use case 90
Figure 51 changes application components layer AS-IS use case 90
Figure 52 Context-based persona use case 92
Figure 53 customer journey layer TO-BE use case 93
Figure 54 Business service layer TO-BE use case 93
Figure 55 Business process layer TO-BE use case 94
Figure 56 Application services layer TO-BE use case 94
Figure 57 Application components layer TO-BE use case 95
Figure 58 Questionnaire results Perceived usefulness 99
Figure 59 Questionnaire results Perceived ease of use 100
Figure 60 Questionnaire results Intention to use 100

Figure 61 Mapping layers 101
Figure 62 Update persona, including traceability 104

Table of tables

Table 1 keywords relevant literature 10
Table 2 Sources for need requirements 22
Table 3 Links between the customer journey and the business service 31
Table 4 Links between the Service blueprint, customer journey and the business process 33
Table 5 Structure requirements 40
Table 6 Schedule 59
Table 7 Categories for discussion research questions 62
Table 8 Categorisation of post-its and audio fragments 63
Table 9 Clustering Architecture guidelines 66
Table 10 Clustering Contextual need guidelines 67
Table 11 Clustering Colour traceability guidelines 69
Table 12 Clustering perceived ease of use 70
Table 13 Clustering Perceived usefulness 71
Table 14 Clustering Intention to use 72
Table 15 Structure requirements 103

1. Introduction

This chapter gives an introduction about the background of this research. It gives an indication about the gap in scientific research and what the objective of this thesis is. This chapter describes the motivation, the objectives, the proposed solution, the research approach and the scope of this research

1.1. Motivation

The customer journey is the process the customer goes through when fulfilling a goal. Customer journey analysis is a systematic approach that helps organisations to understand expectations of customers to create an optimal experience (Halvorsrud, Knut, & Følstad, 2016). An optimal customer journey creates competitive advantage and supports the customer experience objectives (Nenonen, Rasila, Junnonen, & Kärnä, 2008). Customer journey is by definition a context-driven approach, which allows to identify and contextualise patterns to promote best practices and establish organisational standards (Whiteman, 1997). These patterns can be designed by organisations, e.g. by making use of customer journey mapping (Crosier & Handford, 2012)

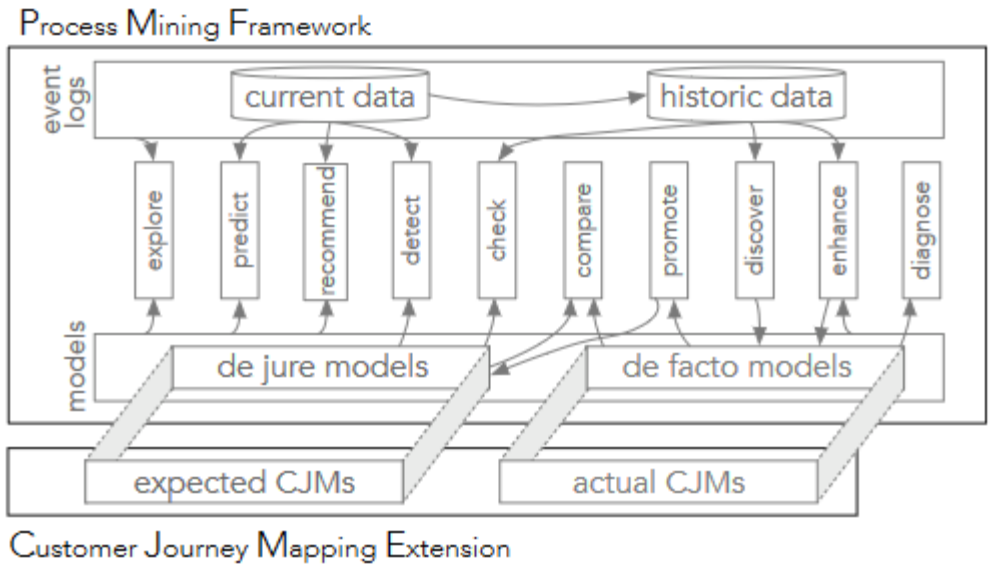

Figure 1 Process mining framework (Bernard & Andritsos, 2017)

Several methods are developed to gather requirements from a customer journey (Lane , O'Raghallaigh, & Sammon, 2016). Some of them are intended to help organisations to understand the customer journey to improve their operations and user experience (Richardson, 2010). For example, Bernard and Andritsos have developed a process-mining framework to compare the actual and expected customer journey (Bernard & Andritsos, 2017). They propose a process-mining model to bridge the gap between the actual and expected customer journey. Tseng et al. have developed a model to map the customer

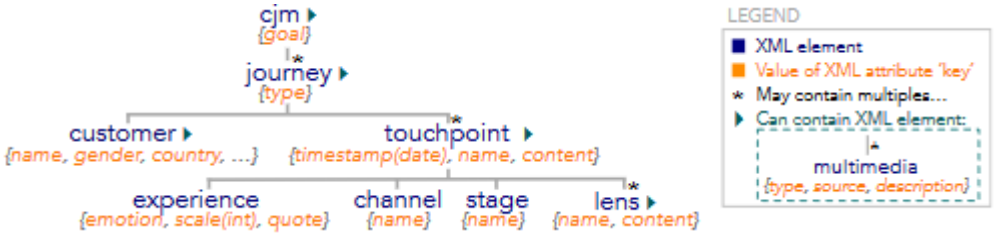

Figure 2 Elements customer Journey mapping (Bernard & Andritsos, 2017)

experience of a customer journey to improve the journey from the view of the customer (Tseng, Mitchell, Qinhai, & Su, 1999). Research shows that adding a multilingual context to customer experience provides organisations extra business value (Subramaniam, 2009). However, current frameworks do not utilise contextual customer journey analysis. When a multilingual context has to be included in the customer journey, a context-driven application architecture is required. In this way, the application architecture enables services for the customer journey (Lankhorst, 2017) with (multilingual) context-awareness for the customer (Efstratiou, Cheverst, Davies, & Friday, 2001).

1.2. Objectives

We observe that future enterprises face the challenge to quickly adapt to different customer contexts. During this research, we explore to what extent the support of a contextual customer journey provides value. Our main research question is:
"how to design a successful process to support contextual customer journeys?"

To answer the main research question, we define the following knowledge (KQ) and design (DQ) questions:

RQ1: What are existing methods to support a customer journey? (KQ)
To answer this research question, we investigate what the needs are for a contextual customer journey. As a proof of concept, we analyse the requirements of the banking business. To elicit these requirements, we conduct interviews with practitioners and a literature research

RQ2: How to support contextual customer journeys? (DQ)
To answer this research question, we make use of a general process to support involvement of contextual aspects and establishes optimal alignment with the enterprise architecture. To design the enterprise architecture, the following sub research questions are needed to be answered:

RQ2.1: How to include contextual aspects in a customer journey?
To answer this sub-research question, literature research is done together with interviewing experts. Based on this, a list of requirements is defined which is required to realise a contextual customer journey.

RQ2.2: How to align the customer journey with the enterprise architecture?
To answer this sub-research question, literature research is done together with interviewing experts. Based on this, a list of requirements is defined which is required to align the customer journey with the enterprise architecture.

RQ2.3: Which components are needed for a contextual customer journey? To identify and define the components of a contextual customer journey, literature research is done. These components are the input for the design to realise a contextual customer journey and will cover the requirements defined in RQ2.1.

RQ2.4: What is the impact of changes with the implementation of a contextual customer journey? As a proof of concept, we analyse the case of a Dutch bank including a new contextual aspect

RQ3: What are the stakeholders' perceptions when validating the framework? (KQ)
To answer this research question, we validate the customer experience of the contextual customer journey. To fulfil the validation, we conduct different qualitative protocols, like a questionnaire and a focus group session with stakeholders, in order to investigate practitioners' perceptions. To measure the successfulness of the process, we will look at the following variables: Perceived ease of use, perceived usefulness and the intention to use. For the realised artefacts for the process, we will check if the stakeholders understand the goals, operations and methods of the realised artefact. As a result, we identify the positive aspects and opportunities to improve the contextual customer journey architecture.

1.3. Research Approach

This chapter describes the approach and methods which are used during the stages of the research.

1.3.1. Literature Review

To get insights in the definitions and the current researches about customer journeys, contexts and application frameworks, we conduct a literature review. The results of this review are input for the design of the artefact. To conduct the literature review, we make use of two methods: The systematic review and the snowballing technique. The systematic review is based on the theory of Kitchenham. When making use of the systematic review, the quality of evidence increases (due to completeness based on the described review protocol). In this way, the given definitions are more robust (Kitchenham, 2004).

The snowballing technique is used for the paper of Bernard and papers with at least 100 citations to go more in details and backgrounds for the information used in these papers (Greenhalgh & Peacock, 2005).

The literature review is performed for descriptions of elements and the alignment between the customer journey, the context and the enterprise architecture.

1.3.2. Design science cycle

In order to answer the research questions to realise the contextual customer journey, we conduct a design science project (Wieringa R. , 2014). The design science method is a problem-solving process which focuses on investigating and designing artefacts (created for practical purpose). The Design science cycle consists of three tasks: Problem investigation, problem design and treatment validation. In the Problem investigation phase, we investigate the literature and the current needs from industry (RQ1). As a proof of concept, we analyse the current customer journey support of a company in the Dutch banking sector. The company has provided a use case to analyse potential improvements that contextual customer journey can bring. In the Treatment design phase, we design an artefact (process) which treats the problem (RQ2). In the Treatment validation is validated if the designed artefact treats the problem. To prove this, we conduct qualitative evaluation to gain insights on how the process is perceived by the stakeholders (RQ3). An overview of the activities is given in Figure 3.

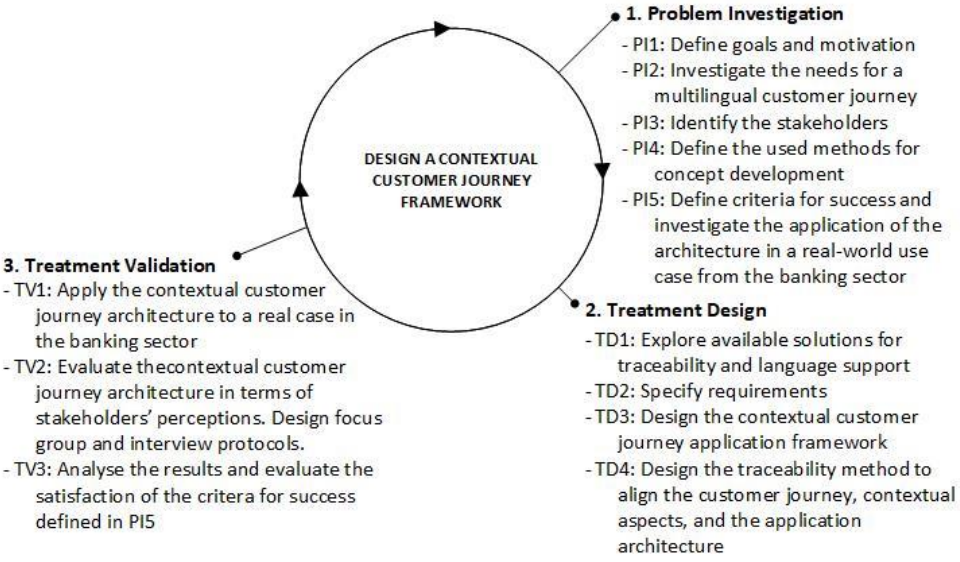

Figure 3 Design Science Cycle (Wieringa, 2014)

1.3.3. Use case

To evaluate the designed artefact (process), we conduct a use case as described by the theory of Yin (Yin, 2011). For the use case, a proof of concept for the enterprise architecture in combination with contextual customer journey is realised at ContextBank[1]. Based on the proof of concept, we fulfil a validation during the project. This validation is fulfilled by doing a focus group (Morgan, 1997). By validating the use case, we check what the strengths and issues are. In this way, improvements can be made on the process.

[1] To protect the privacy of the organisation, we make use of pseudonyms for the sake of readability calling the company ContextBank

2. Literature review

This chapter describes the theory which is already available in the literature. It describes the aspects of the customer journey, the context (with focus on the multilingual context) and the enterprise architecture. We also check how these three aspects can be aligned with each other.

When searching for relevant literature for the support of the thesis keywords per theme are used (see Table 1).

Table 1 keywords relevant literature

Customer journey	**Context**	**Enterprise architecture**
Customer Customer journey Customer experience Customer journey mapping Customer patterns User experience User journey	Multilingual Context Multilingual context Contextual aspects Contextual elements	Application architecture Enterprise architecture
Customer journey alignment Context	**Customer journey alignment enterprise architecture**	**Context alignment enterprise architecture**
Persona Customer journey context Customer context	Service blueprint Customer journey application architecture alignment	Application architecture Enterprise architecture context

2.1. Customer journey

A customer journey is the process where the customer goes through when fulfilling a goal (Halvorsrud, Knut, & Følstad, 2016). In this way, the customer wants to achieve a specific goal. In a customer journey, one or more service channel(s)/party(s) are involved (Følstad, Kvale, & Halvorsrud, 2013). Controlling customer journeys allows organisations to manage the expectations and experiences of a customer. The customer journey is used by organisations to understand the expectations of the customer. By making use of a systematic approach, the organisation wants to create an optimal experience (Nenonen, Rasila, Junnonen, & Kärnä, 2008). To get an overview of a customer journey, the organisation maps the customer journey. Customer journey mapping is seen as a method to identify the key processes that the customer encounters when they interact with the organisation. In this way, organisations get an overview of the needs and preferences of their customers. Based on these needs and preferences, organisations can improve the customer journey. Customer journey mapping can be useful for organisations with customers which have complex processes, several service providers involved or multiple needs (UK Government Cabinet Office Customer Service Excellence, 2017). Andrews and Eade also state that customer journey mapping has the potential to create streamlined, easy to use services allowing customers to create the most effective use of the services (Andrews & Eade, 2013). This results in satisfaction, increased revenue and lower costs for organisations (Rawson, Duncan, & Jones, 2013).

Organisations should keep in mind that several aspects are influencing the customer journey. The paper of Lemon and Verhoef state two types of influences: Dynamic and external

influences. Dynamic influences are experiences of the past which influence the current experience of a customer. External influences are factors like environments and the economic situation, which can influence the experience of the customer (Lemon & Verhoef, 2016).

2.1.1. Elements of a customer journey

Bernard and Andritsos (2017) describe several elements which are used to describe a customer journey. A *Journey* is a path which a stakeholder/*customer* follows. The customer is the stakeholder who is experiencing the *journey*. The *customer* is also known as the 'persona' of the journey. A *touchpoint* is the interaction between a company their products/services with the *customers* of the organisation. *Touchpoints* are used to create a customer journey. A set of *touchpoints* can be seen as a *stage* in the process of the customer journey. When a *customer* goes through the *Stages* of the journey, he/she gets an *experience*. The *experience* can be seen as the feedback and *emotions* the customer has during the *journey*. Experiences in the *touchpoint* of a customer journey can affect the follow up *touchpoints* (Lemon & Verhoef, 2016). The customer receives this experience via a *channel*, which is seen as the method to interact with the organisation. Examples of channels can be an online platform or the mobile phone. Lemon and Verhoef state that when organisations make use of channel integration (seamless experience over different channels), the customer journey improves (Lemon & Verhoef, 2016). When an organisation is creating personas for the customer journey, they want to create a *lens*. A *lens* makes it possible to view the customer journey in a specific context.

2.1.2. Customer journey alignment

Two types of customer journeys are available: The expected (also known as the generic) customer journey and the actual customer journey. The expected customer journey gives an overview of the journey how it should be. The expected customer journey is also known as the generic customer journey. The expected customer journey is seen as the journey which the organisation expects where the customer goes through when they interact with the organisation. Organisations realise the expected customer journey using internal resources. Every customer fulfils their own journey and have their own experience. One type of customer journey does not exist, because every customer has a different flow in the journey. Organisations can analyse the journey to find the most effective journey patterns, find dropouts and to identify new journey segments (Bommel, Edelman, & Ungerman, 2014).

The actual customer journey is defined as the customer journey that the customer is experiencing. The expected customer journey is used as a theoretical model for the actual customer journey. To map the actual customer journey, organisations have to investigate customer data (Følstad, Kvale, & Halvorsrud, 2013).

The expected and actual customer journey are used in several developed methods to improve the customer journey

Bernard and Andritsos have developed a method to decrease the differences between the actual and the expected customer journey. By making use of process mining, a set of tools is provided which help to discover and monitor processes based on real events (by making use of event logs). By making use of algorithms of process mining, current customer journeys can be discovered. These current customer journeys can be compared by another algorithm with the expected customer journey to improve the mapped customer journey (Bernard & Andritsos, 2017).

Halvorsrud et al. (2016) has developed the Customer Journey Analysis Framework. It is a 5-phases procedure, which analyses the actual and expected customer journey. Based on the identification of the problem areas (phase 1) and the identification of the expected customer

journey, data is collected and reconstructed for the actual customer journey (phase 3 and 4). Based on the results of the analysis of the actual customer journey, improvements and recommendations are realised (phase 5).

2.1.3. The customer experience

When customers go through a customer journey, they have an experience. The customer experience is defined as the customers' perceptions when they have an interaction with a brand, product or a part of an organisation. The experience is based on the responses which the customer. The responses can be cognitive, affective, emotional, social and physical (Verhoef, et al., 2009). The interactions of the customer in the customer experience links with the touchpoints of the customer journey. The customer gets an optimal customer experience, when the design of the touchpoints is in line with the needs of the customer and the touchpoints are linked to each other (Lemon & Verhoef, 2016). When this is not the situation, the customer can decide to stop the interaction with the organisation.

2.1.4. The 9+ customer journey

When looking at customer journeys, it is possible for the customer to give a rating about the quality of the touchpoints in the customer journey (Halvorsrud, Knut, & Følstad, 2016). When a customer journey is fulfilling the needs of the customer and gives the basic support, a customer gives the journey a 7+ out of 10 rating. As a company/organisation, the main goal is to achieve a 9+ out of 10 customer journey experience. This can be achieved by optimising the peaks (the momentary intensity which are remembered as positive in the future) and end (the last momentary intensity which gives a positive influence on the evaluation) of the customer journey (Warnaars, 2009), so the customers gives a 9 or a 10 rating for the customer journey.

2.2. Context

Lemon and Verhoef (2016) states that a customer journey experience can be significantly influenced by the context of the user when fulfilling a customer journey. Context is described as the implicit situational information of a system or organisation. This means that the context can be seen as any information (Abowd, et al., 1999). It characterises the situation of entities that are relevant for interaction between user and application. The context deals with places, people and objects. Each of these entities consists of four categories: identity, location, status and time (Baldauf, Dustdar, & Rosenberg, 2007). A context has two types of views: The representational and the interactional view. The representational view consists of contextual information of a customer which does not change over time, while the interactional view is dynamic and based on the activities of a user. Software can also be aware of the context. Context-awareness means that a system can adapt to the contextual situation of a customer. In this way, the user satisfaction increases and predictions for users are more accurate (Adomavicius, Mobasher, Ricci, & Tuzhilin, 2015). Researchers have tried to specify generic context-aware features, but these seem to be too specific. Dey (2001) has specified that a context-aware system can support three categories of features:

- The presentation of services and information to the preferences and background information of a user
- Automatic execution of services for a user
- The tagging of context to information to support later retrieval of the user

2.2.1. Multilingual context

Multilingual (also known as multilingualism) is the ability to speech or write more than one language (Dutcher & Tucker, 1996). Due to the fact that semantic data is becoming more available on the web, organisations have to deal with customers which want to interact with the organisation in their own language. This means that multilingualism is becoming more important in computing (Gracia, et al., 2012).

Intercultural communication

Intercultural communication is the national differences between countries which interrupts the sending and receiving of messages (Lauring, 2010). Due to the diversity of different cultures over the world, it is necessary for an organisation to be aware of such differences while communicating with their customers (Pinto, 2007).

Interpersonal communication

Interpersonal communication is the informal way of communication directed at customers about usage, ownership or characteristics of goods or services delivered by the organisation. When taking interpersonal communication into account, the consumer behaviour can be influenced by advertisement or via social media (Berger, 2014).

Concerns

Based on the paper of Hillier (Hillier, 2003), the following concerns can occur while translating text:

- Meaning of words – Words and sentences can mean something different in different countries.
- Agreement on terminology – different types of terminology. For example, nr. And # can have the same meaning, while these are not common in the Chinese language.
- Untranslatable phrases and meaning – Phrases and meanings may not commonly be used in other countries or have a complete different meaning. These phrases and meaning thus require a completely different context to be used.
- Direction of text – Left to right versus right to left
- Formats – Also known as localisation. The syntax of dates, times and names differs between countries.
- Choice of spelling convention - For example the British spelling differs from the American spelling
- Size of text blocks. Due to the translation of texts to a different language, it can occur that the size of the text (the amount of words) can increase by 40 percent.

2.3. Application architecture

When an organisation wants to manage their complex landscape of systems, they create an architecture. An architecture is defined by Lankhorst as "the fundamental concepts or properties of a system in its environment, embodied in its elements, relationships, and in the principles of its design and evolution". It describes which applications are needed to fulfil the functional requirements, their relations and properties (Pohl, 2010). An architecture gives a view of the system which is designed within the company (Lankhorst, 2017). An application is software which is meant to fulfil a specific task for the user. An application architecture, which is normally described in the application layer, describes the behaviour of applications and how the components interact with each other. One or more applications can support interactions of a user or steps in the process.

2.3.1. Service-oriented application architecture

An application architecture can be service-oriented. A service-oriented application architecture provides a set of design principles of elements and relationships, which adds value to services. These services support the processes of the customer (Lankhorst, 2017).

2.3.2. Elements of an application architecture

When describing an application architecture, the following elements are used (Lankhorst, Enterprise Architecture at work, 2017):

- Applications or components, which enables services
- Relationships, which describes the dependencies of information flows between applications/components or the services which applications/components
- Services, which support the execution of the business process

2.3.3. Design patterns

When looking at an application architecture, companies make use of a design. This design is based on the components which are used to fulfil the needs for the processes of the company. Companies which are delivering services in the same environment have the possibility to confront the same problems over and over again. When this situation occurs, a company can decide to make use of design patterns. Patterns are based on steps which are taken in practice (Heer & Maneesh, 2006). The steps and/or elements are described based on what people do and core elements which are used to fulfil a process/architecture. Architectural patterns established solutions of software patterns for architectural problems.

When using design patterns, a generic solution is described for the problem. This generic solution which can be used multiple times. There are three types of design patterns: Creational patterns, structural patterns and behavioural patterns. Creational patterns are logical patterns to create elements. Structural patterns are the decompositions between different entities or elements. Behavioural patterns are interactions and structure between different elements or entities (Isikdag & Underwood, 2010). When applying design patterns, it is necessary to keep in mind that a design pattern most of the time cannot be used directly as a solution. The design pattern needs to be adapted to the situation of the company (Fowler, et al., 2002).

2.4. Alignment Customer journey and Context

An organisation can create alignment between the customer journey and the context aspect by making use of personas. Personas are a technique which is used to guide decision making for features, interactions and aesthetics. For this technique, fictitious users are realised (Lidwell, Holden, & Butler, 2010). The persona describes the goals, abilities and interests of a user. The description is realistic representative to a real user (Matthews, Judge, & Whittaker, 2012). These personas can be realised by having contact with real users via interviews, contextual checks qualitative means (Thomaz, Junior, & Filgueiras, 2005). Personas consist of ethnographic data, which describes the following types of information:

- Personal information
- Technical information
- Relationship information
- Opinion information

For organisations, the realisation of personas has several benefits:

- Personas are more related to a real-life situation. In this way, software developers can relate more on it than when they are making use of abstract descriptions
- It is easier for software engineers and developers to communicate about personas
- The requirements of the design are more related to the end users

- Personas enables designers to view the system from the lens of other users
- Designers of the software are having the possibility to satisfy multiple types of users, when a set of personas is realised
- Software can be validated by making use of personas. The requirements and needs (which are described in the personas) can be tested against the behaviour of the system
- Personas can inspire the designers for making design decisions in software

One of the findings of Shahri et al. (2016) is that organisations are using personas mainly for communication. The main reasons that organisations are not making use of personas in the design process are that they are difficult to create, too abstract and impersonal (Shahri, et al., 2016).

2.5. Alignment Customer journey and enterprise architecture

To create the optimal customer experience, it is necessary that there is a nice flow in the customer journey. To realise this flow, alignment is needed between the customer journey and the enterprise architecture. Two steps are required. First, the customer journey needs to be translated to the business process. For this translation, several methods are developed. When the customer journey is translated to the business process, several steps are needed to make a translation to the applications which are needed in the application architecture. For this translation, the Enterprise modelling technique developed by Lankhorst et al. (2017) is used.

2.5.1. From customer journey to the business process

One of the main methods which is used by companies to translate the customer journey to the business process is service blueprinting (see Figure 4). Service blueprinting is defined by Shostack as a method to develop processes from the perspective of the customer (Shostack, 1984). The main difference between customer journeys and service blueprinting is that the service blueprinting describes the underlying activities and shows the observable actions, while customer journeys go more into detail in the experience the customer has when interacting with an organisation (Lankhorst, Enterprise Architecture at work, 2017). The service blueprint consists of the following components: Customer actions, onstage level, backstage level, support processes and physical evidence (Bitner, Ostrom, & Morgan, 2008). The onstage level describes the elements where the customer is aware of. It describes the actions in the process which the customer needs to fulfil to complete the process.

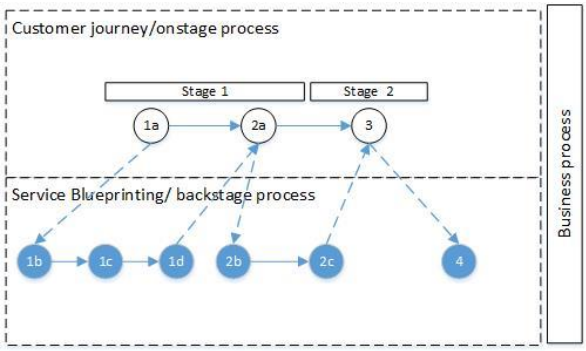

Figure 4 Service blueprinting

The backstage level describes the support process steps. These steps are fulfilled by the organisation and not visible actions for the customer. The organisation is required to perform these steps to get a successful flow in the process (Spraragen & Chan, 2008). The link between the customer journey and the service blueprint are the touchpoints (customer journey) and the customer action (service blueprint). Both elements describe the interactions from the customer. Based on the touchpoints in the customer journey, the onstage level can

be described and the support process steps can be linked in the service blueprint. In this way, a concrete overview of the process steps is realised (Lankhorst, Enterprise Architecture at work, 2017). The use of service blueprinting has several advantages and disadvantages. The main advantages of service blueprinting are that it creates a comprehensive description of the process and the value of the customer is taken into account for innovations (Bitner, Ostrom, & Morgan, 2008). It gives insights in the underlying activities to improve processes. The disadvantages are that service blueprinting is from a more company perspective than customer perspective and that blueprints only shows the observable actions (Nenonen, Rasila, Junnonen, & Kärnä, 2008).

An alternative for the service blueprinting is the sequential incident technique (also known as SIT). SIT is used to map incidents and steps in the process by making use of interviews. Based on in-depth interviews with customers can be decided which changes have to be made in the process. The main advantage of SIT that it gives specific and complete customer insights in the improvements, which makes the technique more customer focused. The main disadvantages are that SIT is time consuming and it is only applicable in an individual setting than a representative customer setting (Stauss & Weinlich, 1997).

2.5.2. From the business process to the application architecture

When the business process is visualised, it is possible to translate to the application architecture (see Figure 5). When looking at the literature of Lankhorst (2017), he describes how viewpoints can represent an architecture. These viewpoints can be used for communication, validation and commitment (Rozanski & Woods, 2011). When looking at the business process which is realised by making use of service blueprinting, it can be linked to the business process viewpoint described by Lankhorst. The business process viewpoint shows a global overview of all the business processes and how they are linked together. For each business process, a sub viewpoint is realised (if necessary), which describes the steps of a business process in detail.

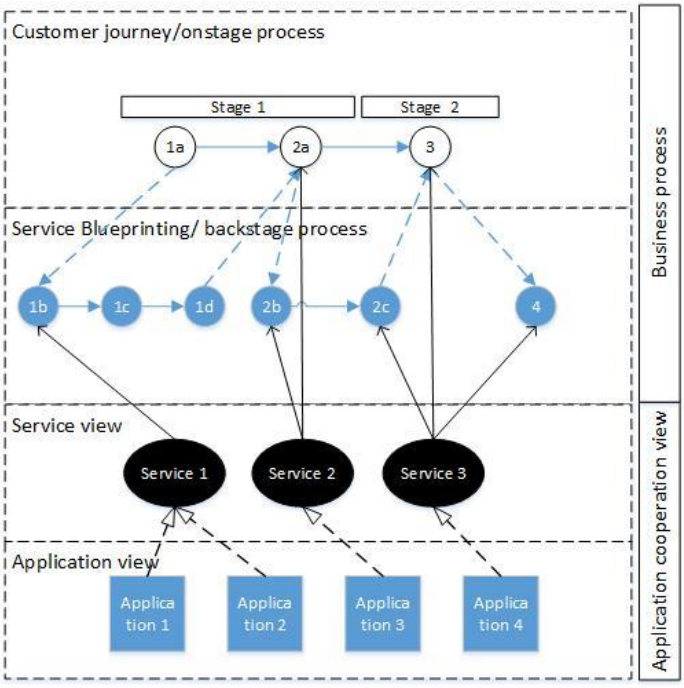

Figure 5 Business process to application architecture alignment

For the translation from the business process to the application architecture, two viewpoints are needed to be realised: The application usage viewpoint and the application cooperation viewpoint.

Application usage viewpoint
The application usage view describes which applications are used to support one or more business processes within the organisation. It describes which applications are needed to fulfil a step in the process (Lankhorst, 2017). It also gives guidelines in the order of the processes, due to the fact that can be identified which processes and applications are dependent of each other.

Application cooperation viewpoint
When an organisation wants to get insights in dependencies between the different applications, the application cooperation viewpoint can be used. By making use of this viewpoint, the relations are shown between applications and/or components. These relations are based on information flows which are required to let applications fulfil their job for the business process. By making use of the application cooperation view, an application landscape is realised.

2.5.3. Customer journey improvement by process mining

To improve the customer journey, Bernard et al. propose a framework based on process mining (Bernard & Andritsos, 2017). Their framework aligns the expected customer journey with the actual customer journey. The expected customer journey is the current journey as defined in documentation. The actual customer journey includes event logs describing emotions and experiences of customers, and the behaviour of a customer during touchpoints in their customer journey. Process mining discovery, enhancement and conformance techniques, like the refined process mining framework (Aalst, 2016) , can then be applied to bridge the gap between the actual and the expected customer journey (Bernard & Andritsos, 2017). This results in a set of improvements and recommendations that need to be translated into changes in the application to improve its alignment with the customer journey.

2.6. Alignment Context and enterprise architecture

To align the context with the enterprise architecture, components and/or applications are required to be implemented in the application architecture to realise context-awareness during the customer journey of the customer (Efstratiou, Cheverst, Davies, & Friday, 2001) it is necessary to gather requirements of the specific context. These requirements are documented in a requirements list. In this way, requirements can be communicated between development teams and stakeholders of the system. It can also be validated if requirements are consistent, complete and real. Based on the list of requirements, functionalities are defined (Lucia & Qusef, 2010). To realise these functionalities, it is necessary to implement components/applications in the application architecture, which provides services. Based on the solution (combination of applications/components which is necessary to realise the solution for a set of requirements), can be checked by describing the AS-IS and TO-BE situation (Aurum & Wohlin, 2005). In this way can be visualised how the application architecture changes when a specific context (contextual aspect) has to be implemented in the application architecture.

2.7. Conceptual framework

Based on the terms which are found during the literature review, we have created a conceptual framework. This framework includes an overview of the links between terms around the customer journey how contextual aspects are related to it and how the customer journey is linked to the application architecture.

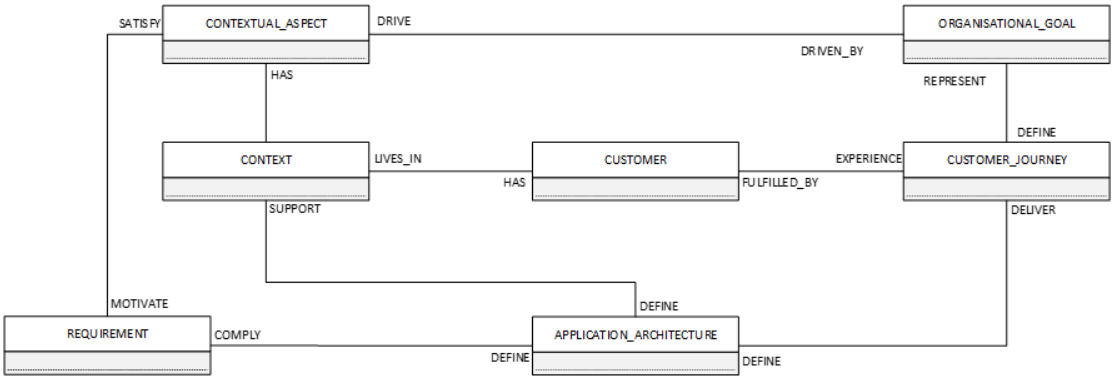

Figure 6 The conceptual framework

The contextual aspect is driven by an ORGANISATIONAL_GOAL which an organisation wants to achieve. By making use of this framework, alignment is realised between the CUSTOMER_JOURNEY, the CONTEXT and the APPLICATION_ARCHITECTURE. It describes how a CONTEXTUAL ASPECT can be implemented, which is driven by an ORGANISATIONAL_GOAL. An ORGANISATIONAL_GOAL describes strategic objectives of the organisation. The ORGANISATIONAL_GOAL also defines some key performance indicators, which are used to measure the CUSTOMER_JOURNEY. The CUSTOMER_JOURNEY is fulfilled by a CUSTOMER that is living in some CONTEXT. The CUSTOMER experiences the CUSTOMER_JOURNEY. The CONTEXT and the CUSTOMER_JOURNEY together define the APPLICATION_ARCHITECTURE. To implement a CONTEXTUAL_ASPECT in the APPLICATION_ARCHITECTURE, a list of REQUIREMENTS have to be realised. The set of REQUIREMENTS is used to define a solution, which is implemented in the APPLICATION_ARCHITECTURE.

2.8. Main findings and discussion

In this section, we summarise the main findings presented in sections 2.1 till 2.6. The main gap of this research is that there is no framework/process realised yet to implement a contextual aspect into a customer journey with alignment to the application. To discuss the main findings, we go into detail for the three main elements (customer journey, context and application architecture) and the alignment between these elements. we also discuss what the main problems are from a practitioners' perspective what difficulties are found.

2.8.1. Customer Journey

Customer journeys are used to show the process of a customer when they are fulfilling a specific goal. Organisations map these journeys (the touchpoints) to get insights in the expectations of their customers during the journey (also known as the expected customer journey. Around these touchpoints, organisations gather information (actual customer journey) to improve the customer journey. By making use of process mining, the gap between the expected and actual customer journey can be decreased. When the organisation aligns with the actual journey and improve low-rated touchpoints, customers have an

increased customer experience. When customers are having an outstanding experience, they have an 9+ out of 10 experience.

2.8.2. Context

The context describes any situational information, which describe entities which are relevant during the interaction between the user and the organisation. When organisations make use of context-aware systems, they can automatically adapt to contextual information. The main problem of describing the context, is that it is difficult to create a standardised set to use in a context-aware system. Context-aware systems can be categorised in three categories: The presentation of services and information, automatic execution of services and tagging of context to information for later usage.

2.8.3. Application architecture

An application architecture is part of the enterprise architecture and shows the fundamental concepts and/or properties of a system. There are several types of application architectures, where the focus is on the service oriented architecture. This application architecture shows the services which support the process of the customer. Design patterns are often used in architectures to ease the creation of systems.

2.8.4. Alignment

Customer Journey to Context
Personas can be described by organisations to align the customer journey with the context. A persona describes elements (goals, abilities and interests) of a user, which can support the decision making of an organisation.

The main gap for the alignment between the customer journey and the context is that no research has been done about which contextual information has to be added for a user to realise the contextual environment and how this affects the customer journey. It is also not clear how these elements have to be implemented in the persona/description of a user.

Customer Journey to Enterprise Architecture
Two methods are required to align the customer journey with the enterprise architecture. First, service blueprinting is used to visualise the business process around touchpoints in the customer journey. After the Business process is visualised, two methods realised by Lankhorst are used to show the applications which are used for the process and cooperation between those applications: The application usage viewpoint and the application cooperation viewpoint.

The main gap for this viewpoint is how to translate the improvements of the customer journey (when making use of the process mining framework of Bernard and Andritsos) to the application architecture (which improvements are needed in the application architecture?).

Context to Enterprise Architecture
To align/implement a contextual aspect into an application architecture, it is necessary to define a set of requirements. These requirements can be translated into a solution, which has to be implemented in the application architecture. This is visualised by describing the AS-IS and TO-BE situation.

The main gap for this alignment is that there it is not clear which requirements are specifically linked to a contextual aspect. It is also not known what the design is for the metamodel of the requirements list and how to visualise these changes in the application architecture.

2.8.5. Practitioners' perspective

To get insights in the need of this process from a practitioners' perspective, some interviews are held with stakeholders from the banking business. In the banking business, they want to create a great experience for their customer (also known as the 9+ out of 10 experience). To realise this, they have to look from the perspective of the customer. The main question for them is how to quickly adapt to a specific situation (*Oost1)*[2]. The main problems which the stakeholders see in the banking business is that some elements are not delivered in the systems of the bank, while these elements can improve the customer experience. The processes are also not thought from a customers' perspective (*Focusgroup1) (Oost1)*. Personas to describe customers are used on the fly. They define them based on interviews, but the personas are not always updated. This means that some contextual aspects are not taken into account/missing when developing a journey (*Katen1*).

[2] The codes which are described in the text, are used as evidence for requirements in chapter 4.

3. The Contextual customer journey process

This chapter describes the principles of the contextual customer journey process. The main goal is to describe how an organisation can include contextual aspects in their customer journey and how to translate these into the enterprise architecture (focus on the business and application layers). First, the purpose of the process is described. Based on the findings in chapter 3, a description is given of the process how the user has to go through the process. After the process is described, the elements and methods which are used in each step to fulfil the process is explained.

3.1. The requirements

The contextual customer journey process provides an overview of changes in a customer journey. The main goal of the process is to ensure the satisfaction of the end-user goals based on the experiences (by making use of the event logs) and the context (by including contextual aspects) of the users. Based on the main findings and discussion from a theoretical and practical perspective in chapter 2.7, requirements are realised to achieve the main goal. The contextual customer journey process should meet the following requirements:

- **R1** - A step-by-step process description should be established to facilitate the use of the process
- **R2** - The user experience should be analysed in a systematic way to design an optimal customer journey
- **R3** - The contextual aspects of a user should be elicited, described and realised in order to provide a TO-BE customer journey which supports contextual aspects
- **R4** - Guidelines are required which will help in the facilitation of the implementation of architectural aspects for the TO-BE customer journey, i.e. business services, business processes, application services and application components.
- **R5** - Explicit traceability between the customer journey and the enterprise architecture should be supported.

The requirements above are derived from the gaps and complications which were found from a theoretical and practical perspective. In Table 2, a summary is given from sources and quotes which indicate the need.

Table 2 Sources for need requirements

Requirement	Practitioners perspective	Academic perspective
RQ1	Focusgroup1	
RQ2	Oost1	(Bernard & Andritsos, 2017);
RQ3	Katen1	(Whiteman, 1997)
RQ4		(Lankhorst, 2017); (Bernard & Andritsos, 2017); (Shostack, 1984)
RQ5		(Bernard & Andritsos, 2017); (Halvorsrud, Knut, & Følstad, 2016); (UK Government Cabinet Office Customer Service Excellence, 2017); (Boer, et al., 2005)

3.2. Description of the process

To describe how to make use of the contextual customer journey process, the method conceptualisation is used (Goldkuhl, Lind, & Seigerroth, 1998). Goldkuhl et al. describes that methods are making use of several method components, which offers guidelines for work. Goldkuhl also describes that it depends on the situation if it is necessary to make use of all the described method components for a method. To realise a method which can be learned to integrate within an organisation, it should include the following aspects: The Perspective, the framework, co-operation forms and the method components (see Figure 7).

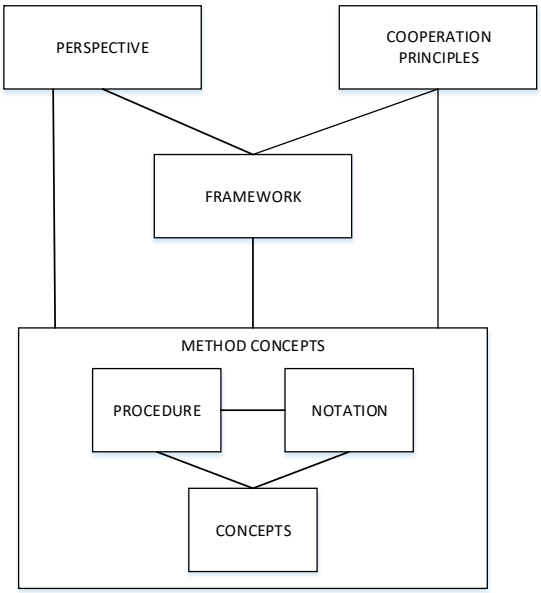

Figure 7 Method notion

The Perspective describes the purpose of the contextual customer journey framework. Cooperation principles describes which roles, skills and structure is required to fulfil a step in the contextual customer journey framework. The Framework gives an overview of the method concepts which are used for the contextual customer journey framework. It describes the relationships between the different method concepts. Method concepts consist of three elements to describe the methods used in the contextual customer journey framework:

- Procedure – Describes the steps which are required to fulfil a method. It also the describes the input and the output of each steps.
- Notation **–** how are the results documented?
- Concepts – Principe of how to combine the procedure and the notations in a method concept

The contextual customer journey framework is described in Figure 8. Chapter 4.3.1. describes the process the user of the framework has to go through to implement new contextual aspects in the customer journey.

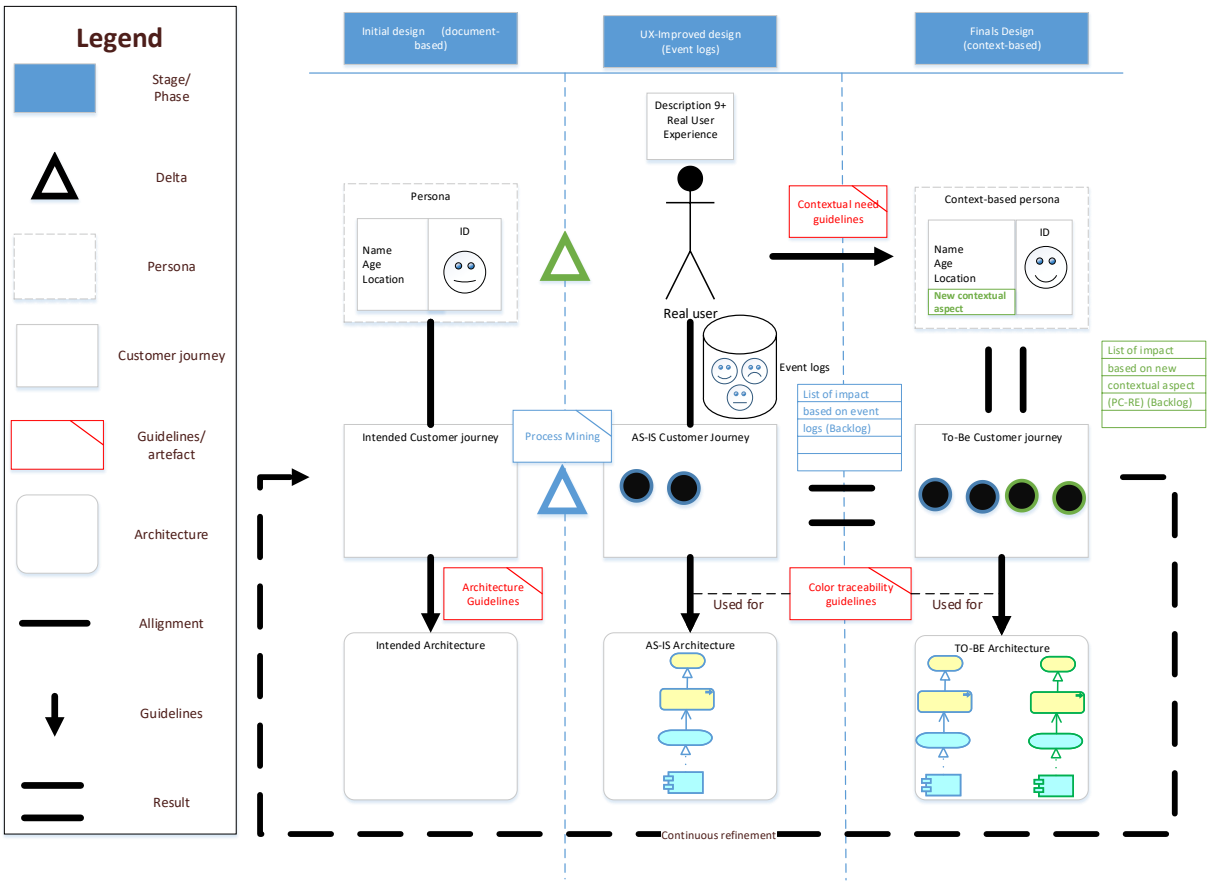

Figure 8 Contextual customer journey framework

3.2.1. The contextual customer journey process

An overview of the steps and method concepts in the contextual customer journey process is given in (see Figure 9). The steps in the process are described in detail in this chapter. Chapters 4.4. till 4.7. provides background information around the methods and techniques which are used for the guidelines to enable the realisation of a contextual customer journey. References to these chapters are given in the process steps where they are used.

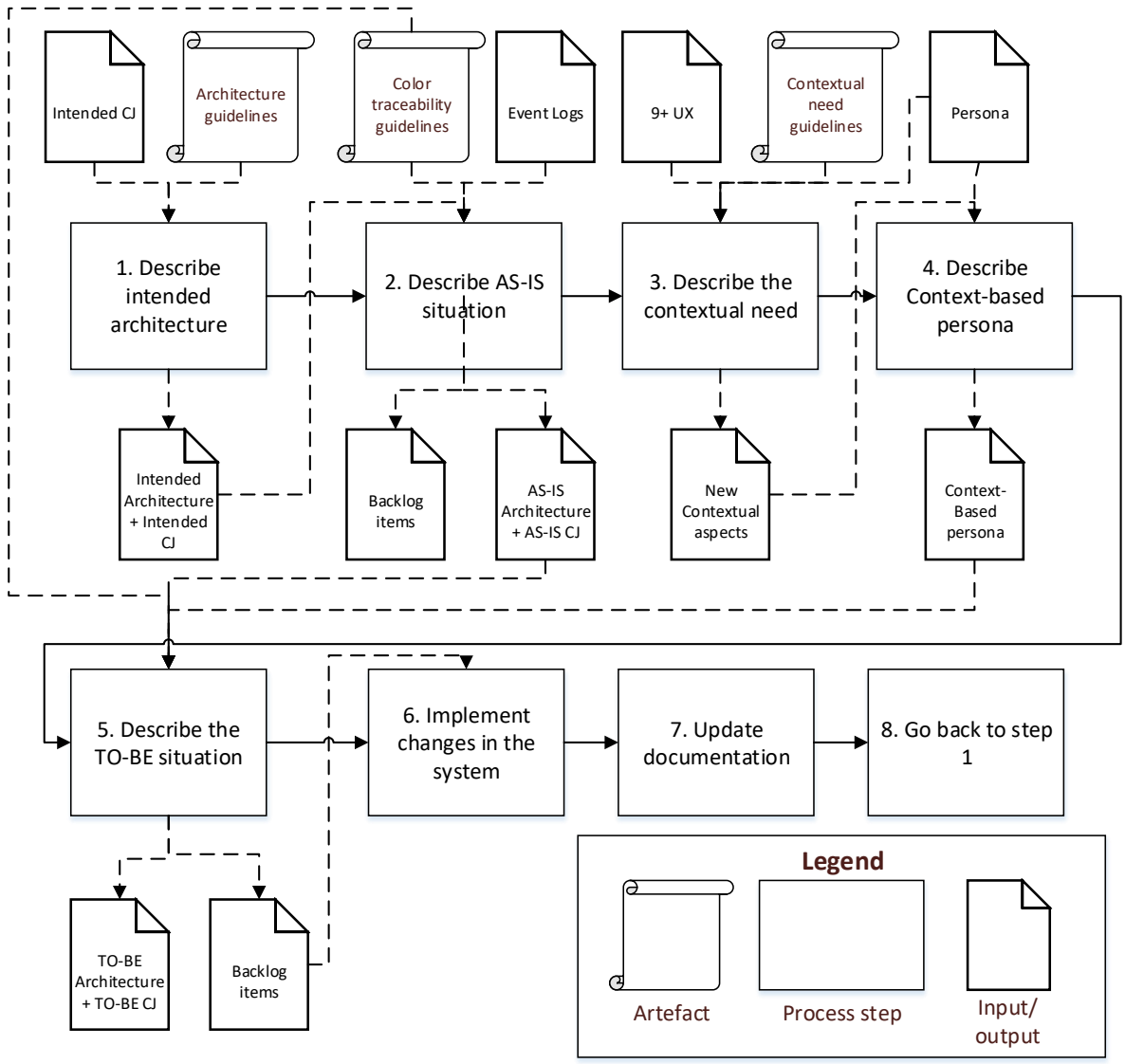

Figure 9 Contextual customer journey process map

To make use of the process, we provide the following steps:

1. **Describe the intended architecture**
   Input: Intended customer journey, architecture guidelines (see 4.5)
   Description: The intended architecture is the customer journey which is already described by the customer journey. Based on this customer journey, the architecture layers can be described to show which business services, business processes, application services and application components are used to realise the intended customer journey. This description can be made by making use of the architecture guidelines to go from a customer journey to the application architecture.
   Output: Description of the intended customer journey and a description of the elements in the intended architecture to realise the customer journey

2. **Describe the AS-IS situation**
   By making use of the process mining framework for customer journey mapping (Bernard & Andritsos, 2017), the process of how the customer actually goes through the journey (compared to the documented journey) can be described. To describe the AS-IS situation, the following steps are required

   a. ***Describe/sign the changes in the AS-IS customer journey***

Input: Intended architecture, Intended Customer Journey, Process mining (Event logs) (see 4.4)
Description: Check for each touchpoint if they are influenced or not. Check also if a new touchpoint should be added to the customer journey which is missing in the documented journey. This can be the case when a customer takes another extra step more often in the process.
Output: Changes touchpoints (AS-IS Customer journey)

b. ***Write down the AS-IS architecture***
Input: AS-IS customer journey, Intended architecture, Colour traceability guidelines (see 4.7)
Description: Based on the changes in the customer journey by the process mining framework, describe which elements (based on the adjustments in the touchpoints) in the business service layer, the business process layer, the application services layer and the application components layer are needed to be changed or which elements have to be included to realise the AS-IS architecture. Fulfil these steps by making use of the architecture guidelines. Describe in a list of changes which changes are required to realise the AS-IS customer journey
Output: AS-IS architecture, traceability links AS-IS, List of changes (based on event logs)

c. ***Include the list of changes in the backlog***
Input: List of changes (based on event logs)
Description: Put the list of changes on the backlog, so that these changes can be included in the customer journey over time. To structure and prioritise the list of changes, the following steps are required:

- *Categorise the new backlog items:* Categorise the list of changes
- *Formulate the new backlog items:* Describe why these items have to be included in the customer journey/architecture. Describe also how to implement these changes
- *Prioritise the backlog:* Based on the new items on the backlog, give them a weight to give them a prioritisation on the list
- *Document AS-IS Situation:* update the documentation of the intended customer journey and the architecture to the AS-IS situation.

Output: Backlog items (based on event logs), Documented AS-IS CJ & architecture

3. **<u>Define the contextual need</u>**
Input: Persona, Real user, Description 9+ Real User Experience, Contextual need guidelines (see 4.6)
Description: After the adjustments in the customer journey based on event logs, it is time to implement the new contextual aspect. Before implementing the new contextual aspect, it is necessary to define the contextual need. By making use of the contextual need guidelines, it is possible to include contextual aspects from a company or from a customer view.
   a. ***Organisational goals/Customer preferences***
      Based on the organisational goals of the organisation or requests by customers, define which new contextual aspects have to be included in the customer journey, which improves the customer experience
   b. ***Define the contextual aspects***
      Define which contextual aspects have to be included in the descriptions of customers (if not already defined). Divide these contextual aspects into three categories: stakeholder group, user characteristics and personal goals.
   Output: New contextual aspects

4. **<u>Describe Context-based persona</u>**
Input: Persona, New contextual aspects, contextual need guidelines (see 4.6)
Description: Based on the contextual aspects items which are defined to fulfil the contextual need of the organisation, define how these affect the descriptions of personas to describe customers. This step also visualises the traceability of the changes in the personas of the organisation. To fulfil this step, the contextual need guideline can be used to improve the description of the persona.
Output: Context-based persona (including traceability)

5. **<u>Describe the TO-BE situation</u>**

After describing the new contextual aspects in the context-based persona, it is time to document the TO-BE situation of the customer journey. After describing the TO-BE customer journey, the TO-BE architecture can be described by making use of the Colour traceability guidelines. To realise the TO-BE situation, the following steps are required:

a. ***Describe/sign the changes in the TO-BE customer journey***

Input: Context-based persona, AS-IS customer journey

Description: Check for each touchpoint if they are influenced or not. Check also if a new touchpoint should be added to the customer journey which is missing in the documented journey. This can be the case when a customer takes another extra step more often in the process. For the affected and new touchpoints by the new contextual aspect, make use of the same visualisation colour as in the context-based persona.

Output: TO-BE customer journey

b. ***Write down the TO-BE architecture***

Input: TO-BE customer journey, AS-IS Architecture, Colour traceability guidelines (see 4.5)

Description: Based on the changes in the customer journey by the new contextual aspects in the persona (based on the contextual needs), describe which elements (based on the adjustments in the touchpoints) in the business service layer, the business process layer, the application services layer and the application components layer are needed to be changed or which elements have to be included to realise the TO-BE architecture. Fulfil these steps by making use of the architecture guidelines. Describe in a list of changes which changes are required to realise the TO-BE customer journey

Output: TO-BE architecture, traceability links TO-BE, List of changes (based on new contextual aspects

c. ***Include the list of items on the backlog***

Input: Context based persona, TO-BE situation list of changes

Description: Write down the contextual aspects on the backlog. Divide the contextual aspects in the following categories:

- *Group:* Customisation based on groups in a specific domain, for expert users etc. Defines the cultural adaptation, like localisation and cultural differences.
- *User characteristics:* Descriptions of groups of individuals who share common skills & abilities. Based on this profile, customisation can be made.
- *Personal goals:* Individual needs for services, task support, attainment goals for self, linked to motivations

Output: Backlog items (based on contextual needs) (for structure, see Table 5)

6. **Implement changes in the system**

Input: Backlog items (based on event logs), Backlog items (based on contextual needs)

Description: After the changes in the persona, customer journey and the architecture are described, it is possible to implement the changes in the system. Pick up the backlog items in a sprint to realise them.

Output: Implemented TO-BE situation

7. **Update documentation**

Input: context-based Persona, TO-BE customer journey, TO-BE architecture

Description: During or after the realisation of the backlog items, the documented customer journey and architecture are outdated. Based on the changes in the customer journey and the architecture, update the documentation where needed.

Output: TO-BE documentation

8. **Go back to step 1**

Input: TO-BE documentation, Implemented TO-BE situation

Description: After the changes are implemented and the documentation is updated, the To-Be situation of the customer journey (and the architecture) can be seen as the new intended architecture. In this way, it is possible to improve the To-Be customer journey with event logs and new contextual aspects.

Output: Intended documentation

3.3. Running example (web shop)

While describing the process and the guidelines which are used in the process, each chapter contains a description of a running example. These descriptions describe for each step in the contextual customer journey process how they are fulfilled in a practical way.

Consider as a running example an online web shop called Studify. Studify sells educational software to students. The main goal of Studify is to deliver students an optimal customer experience, so that they can buy the software which is needed for their study at Studify. To get insights in the behaviour of the students on their website and the fallout rates, Studify registers event logs.

The main problem which Studify encounters is that they do not take into account what a student is studying at which university. Due to this fact, Studify cannot give recommendations of software and a list of study-specific software to their customers. This results in that students do not like the structure of Studify to buy software (fact is based on the reviews which are given by the students) and that they buy their software somewhere else. Studify wants to solve this problem by giving more study-specific recommendations, to create a more optimal experience.

To improve the customer experience of the students, the customer journey of Studify needs to be improved. To improve the journey, the touchpoints of the registration page, the confirmation e-mail and the homepage (to find products) are taken into account (see Figure 10).

The registration page is used to let customers/students write down their details to register. After registration, the customers get an e-mail with the confirmation. After confirmation, the customer has the possibility to login on the website. The homepage shows recommendations, which are defined based on the products the customer has bought.

For each touchpoint, event logs of users are registered by Studify. Based on the event log can be concluded that the e-mail touchpoint and the homepage touchpoint have a neutral and a negative experience.

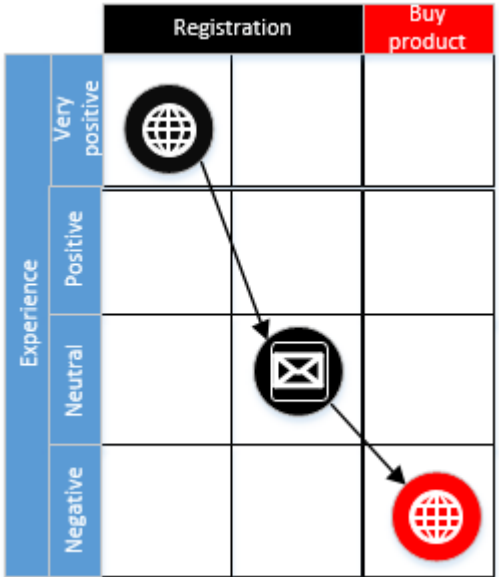

Figure 10 Journey touchpoints web shop

Persona

To test the intended customer journey, the web shop made use of one persona: Kate. Kate is a 21-year-old student and lives in Arnhem. Kate is a 2nd year bachelor student at the university of Utrecht. She wants to get the software for her study at one place for a competitive price. The preferred channels to buy stuff is via the internet. The persona is described in Figure 11.

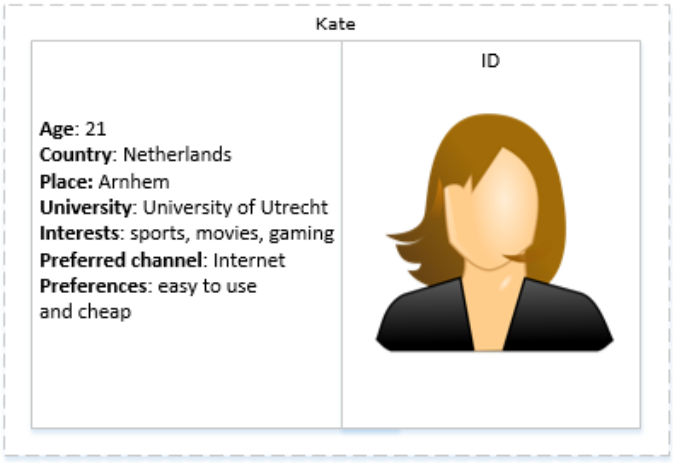

Figure 11 Persona running example

3.4. User experience to the customer journey

When the intended customer journey is described by the organisation, it shows the expected and documented customer journey. The expected customer journey is the journey that the organisation thinks the customer goes through when fulfilling a specific task. This AS-IS does not include any details about how customers are experiencing the journey. Each customer takes different steps to reach their goal. The steps which the customer can be logged by organisations in event logs. Based on these event logs, the actual customer journey can be derived. Based on the expected customer journey which is described in the AS-IS and the actual customer journey can be combined to a TO-BE situation by making use of the process mining framework of Bernard and Andritsos (2017). By making use of this framework, the gap between the actual and expected customer journey is closed.

When making use of the process mining framework, only the event logs are taken into account. This means that only emotions and experiences (like the time, touchpoints and fulfilment of the journey) the customer takes to go through the journey are used to improve the customer journey. In this way, a AS-IS customer journey, excluding contextual aspects and business goals improvements, can be realised.

In our running example we fulfil the following steps to include improvements of the process mining framework in the customer journey:

1. Based on the event logs which are gathered for each touchpoint, is found that the time between the registration of the customer and the confirmation of registration takes more time than expected: Instead of the expected 5 minutes, it takes around 15-30 minutes before the customers receive their e-mail. This leads to a negative experience under the users, because the students have to wait too long before they can activate the account and buy products on the website.

2. Based on the findings in step 1, this means that the e-mail touchpoint has to be affected to change the experience of the user to a positive one.

3. To visualise changed/affected the touchpoint which, give a blue traceability mark to the e-mail touchpoint

A visualisation of the steps above are described in Figure 12.

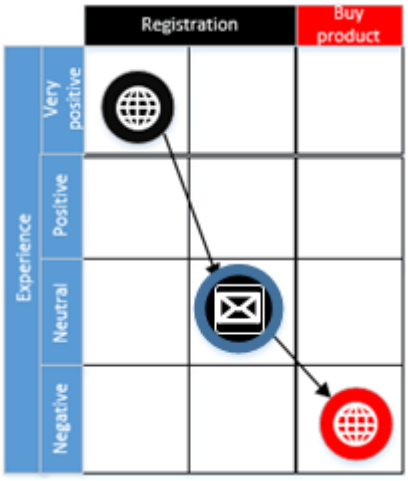

Figure 12 Running example Event logs in touchpoint

3.5. Guidelines to go from the customer journey to the enterprise architecture

When the touchpoints are found which have to be improved in the customer journey, it is necessary that the foundation of the processes and application components which has to be improved/will be improved is described as well. When these aspects are not taken into account, it is not possible to improve the customer journey itself. Lankhorst (2017) describes how elements of the customer journey are linked to the business process of the enterprise architecture. To describe the changes in the enterprise architecture (until the application architecture), the following layers are described:

- Business services
- Business process
- Application services
- Application components

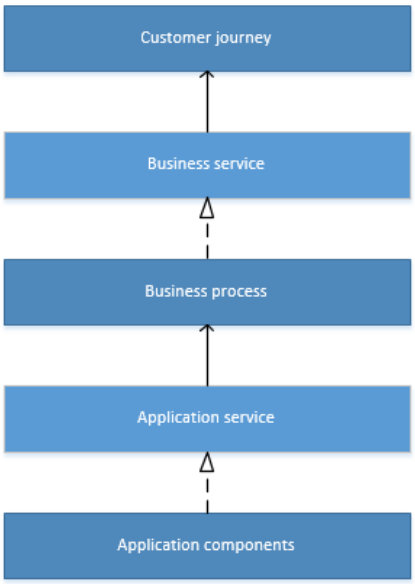

Figure 13 Mapping layers

This section provides a step-by-step plan how to describe the specific elements and components in each layer which are required to realise the customer journey. It is also described how the changes (based on the list with user stories from the analysis of the AS-IS situation) can be changed through these layers.

3.5.1. Architecture guidelines

1. From touchpoint to business service

Customer journey maps do not have a standardised vocabulary. Lankhorst (2017) has described the common aspects between a customer journey and the Archimate concepts to link the business process to the customer journey. When a touchpoint is described in the customer journey, a business service is required to provide it. The customer journey and

the stages which are used to describe the customer journey to divide sets of touchpoints can be seen as one or more business processes. The person(a) is a business role in the business process. The mapping of these elements is shown in Table 3**.**
To go from the touchpoints to the business services, the following steps are required:

1. Link the customer journey and the stages to the business process. They are used later in a later stage of these guidelines (from business service to business process)
2. Link the Persona, which fulfils the customer journey, to the business role
3. For each touchpoint, create a business service which are used during the interaction of the customer with the organisation.

A visualisation of the mapping from the customer journey to the business services is described in Figure 14.

Table 3 Links between the customer journey and the business service

Customer journey elements	**Business service concepts**
Customer journey	Business process
Stage	Business process
Touchpoint	Customer service **(provides the interaction of the touchpoint)**
Persona	Business Role

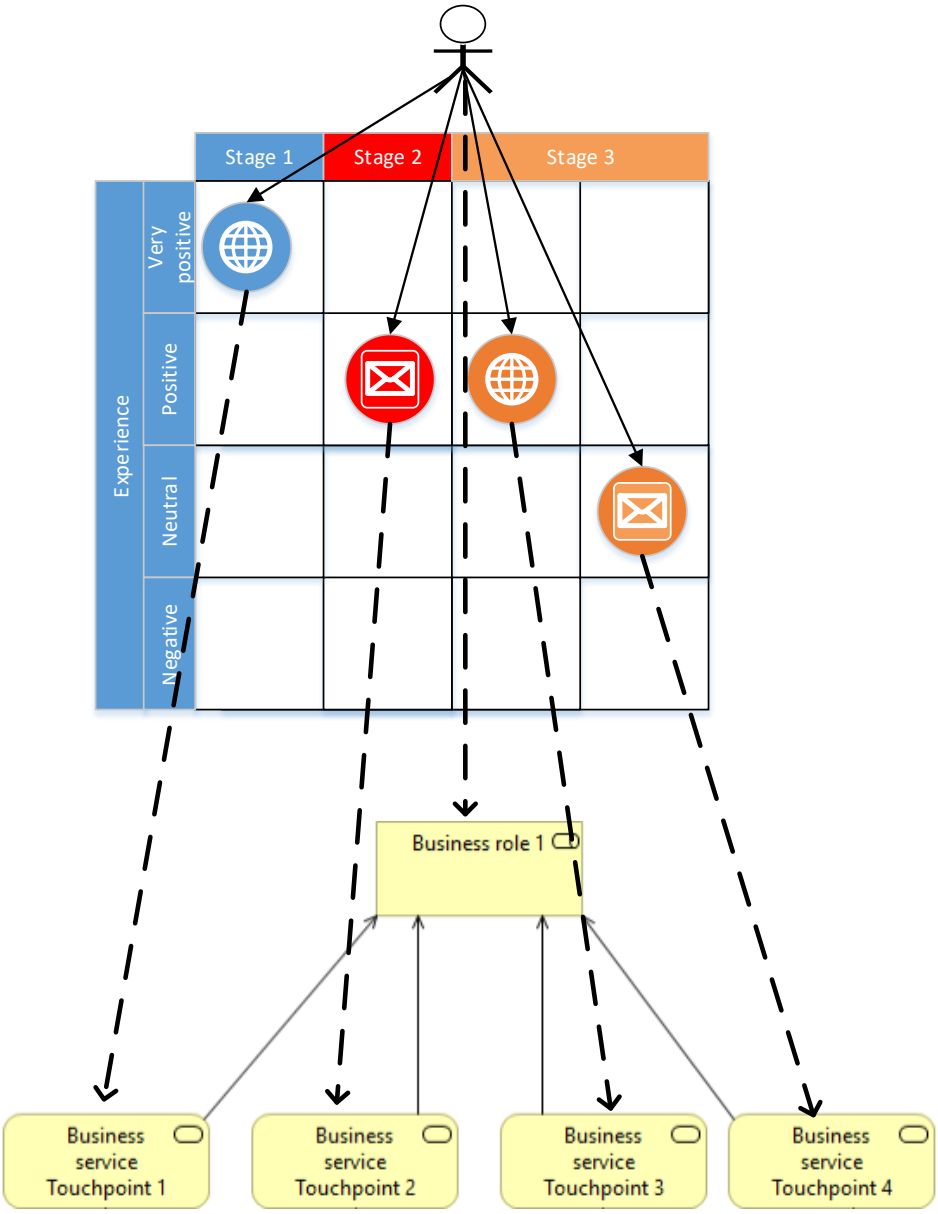

Figure 14 Linking the Customer journey to the Business service layer

2. From business service to business process

To realise a business service, it is necessary to align one or more business processes to the services. This provides the bridge between the service viewpoint and the business process viewpoint. When the business services were visualised for the customer journey, the touchpoints between the customer and the organisation are only defined. To get a complete overview of all the process steps, it is necessary to visualise the process steps which are fulfilled by the organisation. To describe these steps, the service blueprint technique can be used. The service blueprint technique is realised by Shostack (1984). The main difference between customer journeys and service blueprinting is that the service blueprinting describes the underlying activities and shows the observable actions, while customer journeys go more into detail in the experience the customer has when interacting with an organisation (Lankhorst, Enterprise Architecture at work, 2017). When combining these two techniques, it is possible to improve the experience of the customer and the process of the organisation. The mappings of concepts in the service blueprint, customer journey and the business process are described in Table 4.

To go from the business services (which only includes the touchpoints) to the business process, the following steps are required:

1. Describe for each business service (which is mapped to a touchpoint of the customer journey) which customer actions are fulfilled. These are assigned as steps in the business process.
2. When the customer actions are described in the business process, then the organisation has to fulfil some internal steps before the interaction with the customer can continue. To visualise this interaction, the steps which the organisation/employee has to take between each process step of the customer (the touchpoints) has to be described. These steps are not visible for the customer. These steps are also called backstage actions
3. When the backstage actions are described, some support processes can also influence the process (for example: The validation of registration details, payment cards etc.) which are not directly fulfilled by the employee who is interacting with the customer. These supporting processes are needed to deliver a service to fulfil the complete process.

The mapping of each step from the business services to the business process is visualised in Figure 15.

Table 4 Links between the Service blueprint, customer journey and the business process

Service blueprint elements	**Customer journey concepts**	**Business process concepts**
Physical evidence		Business object, data object, representation, artefact, material
Customer actions	Touchpoint	Business process
Onstage actions		Business interaction
Backstage actions		Business process
Support processes		Business process

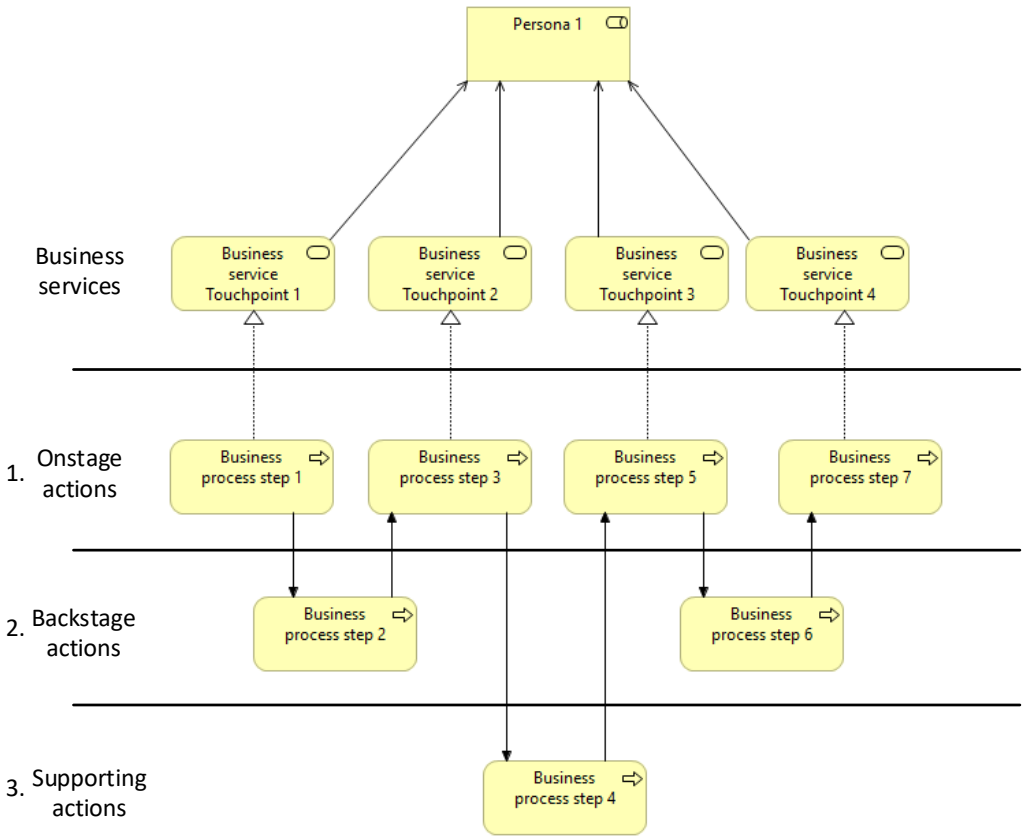

Figure 15 Steps from business service layer to business process layer

3. From business process to application services

When the steps of the customer, organisation and supporting parties are described in the business, the application services can be described. Application services are describing the external behaviour of application component(s). The services describe the functionalities which are made available to realise or support a specific business process. For the application services can also be described how they are collaborating with each other (Lankhorst, Enterprise Architecture at work, 2017).
To link the business process steps to the application services layer, the followings steps are required:

1. Check for each process step which services are required to fulfil the process. Check also if one or multiple services are required
2. Link the application service(s) to the process step by making use of the serving relationship link. In this way can be shown which application service(s) serve the business steps.

The mapping of each step from the business process to the application services is visualised in Figure 16.

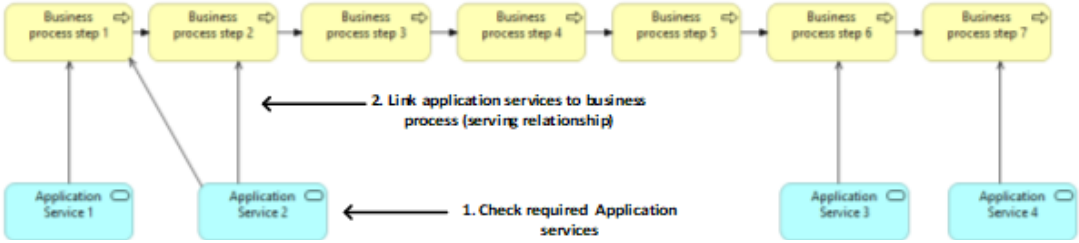

Figure 16 Steps from business process layer to application services layer

4. From application services to application components

To realise an application service, several application components are required. This view enables for each process step and for each interaction of the customer with the organisation (the touchpoint) to show which application components a step in the process is dependent of. The application components show two aspects: The dependencies of application components with application services and the collaboration/information transfer between application components. It creates the view of an application landscape. To link the application services to the application components, the following steps are required:

1. Check for each application service which application components are used to realise the service.
2. Link the application components to the application services by making use of the application realisation link and
3. Check for each of the application components which components are collaborating with each other.
4. Link the collaborating application components by making use of the application dependency links

The mapping of each step from the application services to the application components is visualised in Figure 17.

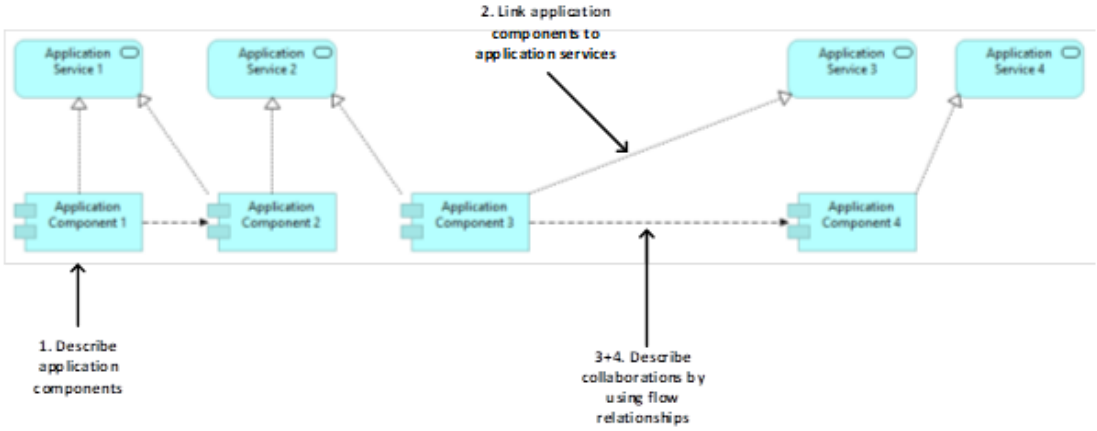

Figure 17 Steps from application services layer to application components layer

In our running example, the architecture is worked out for the three touchpoints of the web shop based on the steps in the architecture guidelines.

1. From touchpoint to business service

In this step, the touchpoints of the customer journey are linked to the business service(s)

1. The Registration and Buying stage in the journey are the stages in the customer journey. They are assigned to the *business processes (will be described later from the business services to the business process)*.
2. The student is in this customer journey the *persona*. This means that the student fulfils the *business role* for the touchpoints in the business process.
3. The Homepage, e-mail and the Registration page *touchpoints* are the *business services.*

The visualisation of these steps for the web shop are shown in Figure 18.

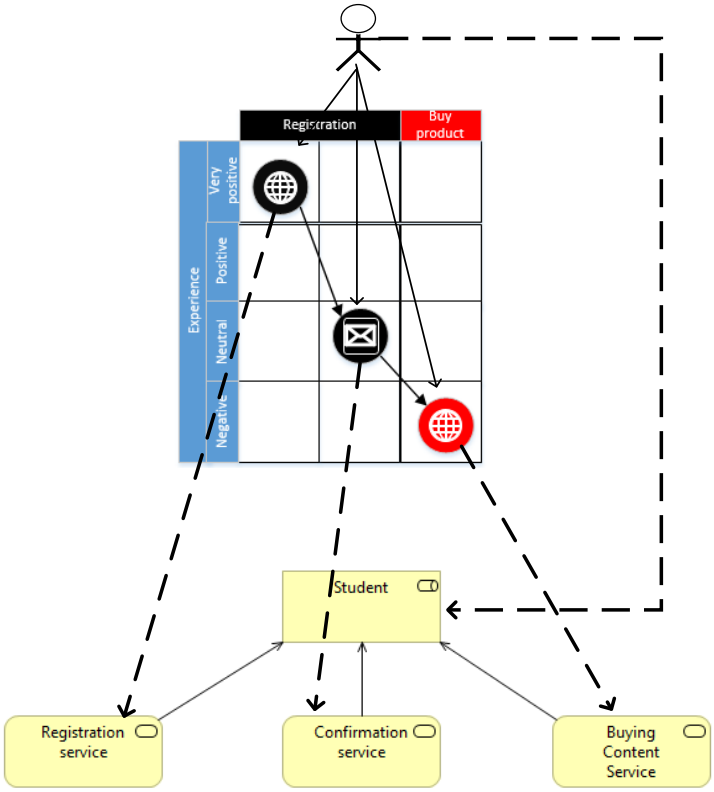

Figure 18 Running example touchpoints to business service

2. From business service to business process

In this step, the business service(s) are linked to the underlying business process(es)

1. The first steps which is described for the business services are the *onstage actions*. These actions are fulfilled by the student. To realise the Registration service, the business steps fill in registration form and send form are required. For the confirmation service, the student has to click on the activation link in the e-mail to activate his account. For the buying content service, the student logging in with his details and he selects the homepage.
2. The second step are the *Backstage* actions. These business process steps are fulfilled by an employee of Studify. The employee has to check the details which the student has filled in after the student has send the registration form. After the details of the student are checked. The details are send to the University. After the university accepted the request, the employee accepts the details, which leads to an confirmation e-mail.
3. The third step is to describe the *supporting actions.* The business process steps are fulfilled by the University employee. The University employee validates if the student is linked to the University. The university employee sends a confirmation if the request is correct.

The visualisation of the business process steps and the links to the business services are shown in Figure 19**.**

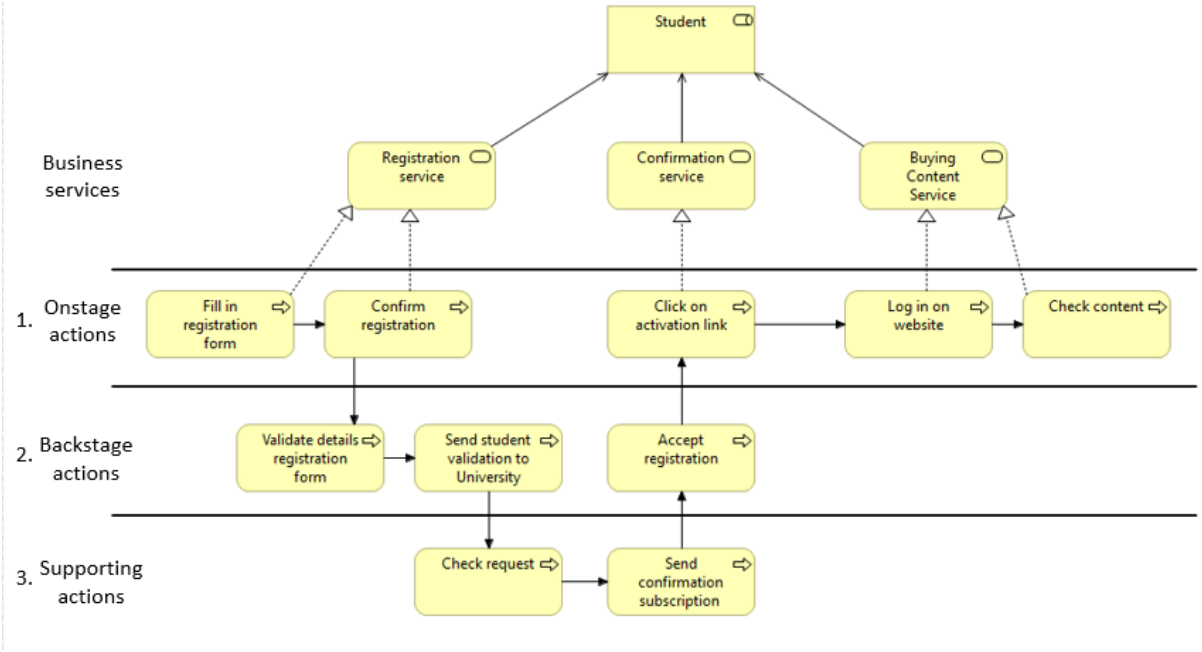

Figure 19 Running example business service to business process

3. From business process to application service

In this step, the business process steps are linked to the application services which enable the steps. These steps are only described for the *onstage* and *backstage actions.*

1. To fulfil the business process steps of fill in registration form, confirm registration, validate details and accept registration, the customer registration service is required. The send student validation to University, accept registration and Click on activation link business process steps make use of the e-mail service, due to the fact that acceptation of the student sends an e-mail to the student and the student clicks on the activation link in the e-mail. To log in on the website, web services are required. To check content on the website, content services are required.
2. Link the application services to the business process steps like described in step 1.

The visualisation of the application services and the links to the business process steps are shown in Figure 20.

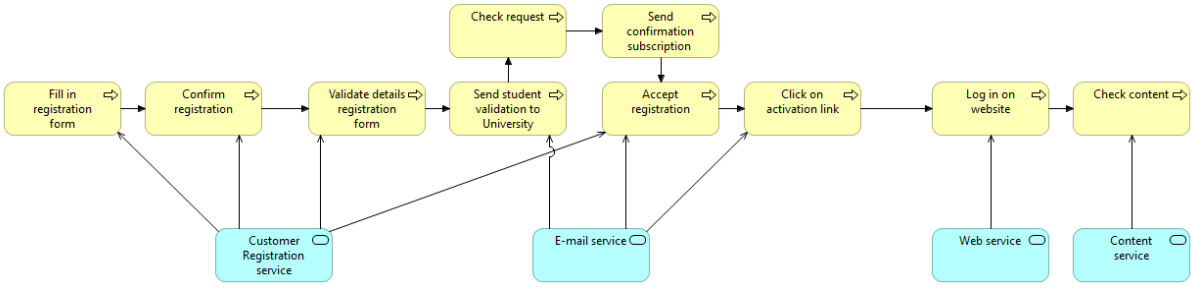

Figure 20 Running example business process to application service

4. From application services to application components

In this step, the application components are linked to the application services, to show how these services are enabled.

1. For the customer registration and the web service, a CRM system is required to save the data of the customers. For the E-mail service, Web service and Content service, a

package of IGM is used. This package contains, Websphere (E-mail service), A database for the content (Content service) and a web application (web service)
2. Link the application components to the application services, based on the links in step 1
3. Several data transfers are done between the different application components. The CRM system is used by Websphere, to check the details of the customer. The CRM system is also used by the web application to check the login details of a customer. The CMS is used by the web application to show the content on the website.
4. Link the collaborating application components.

A visualisation of the application components which enables the application services, is shown in Figure 21.

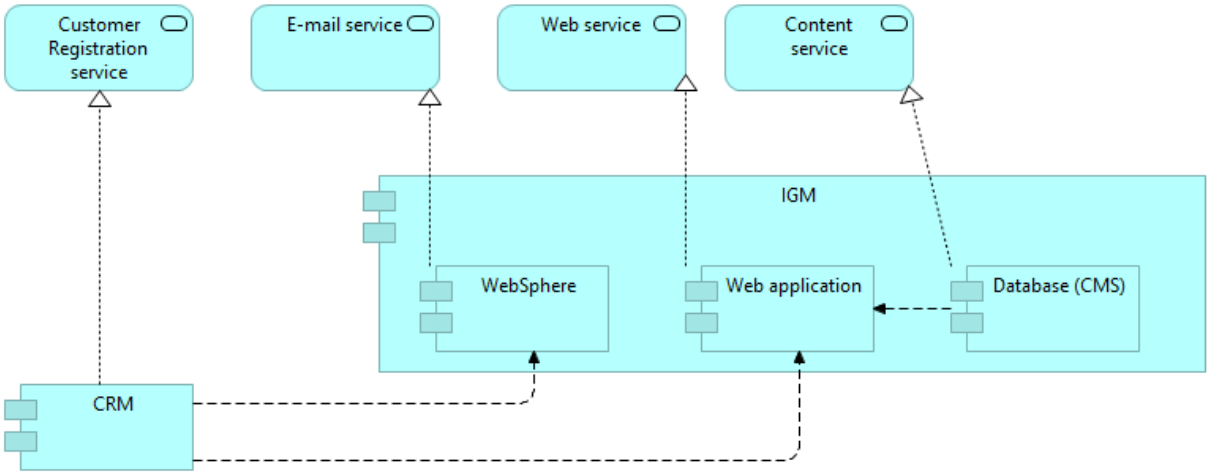

Figure 21 Running example from application services to application components

3.6. Context based customer journey

To create a context-based customer journey, two aspects are taken into account: The personas and the PC-RE framework. After the descriptions of these methods and ways to include contextual aspects, the guidelines are given to include contextual aspects in the customer journey.

3.6.1. Personas

To give an indication of the different types of users which fulfils a journey, test users can be realised by making use of personas. Personas describe the goals, abilities and interests of a user (Matthews, Judge, & Whittaker, 2012), which are a realistic representative. These personas can be realised by having contact with real users via interviews, contextual checks qualitative means (Thomaz, Junior, & Filgueiras, 2005). Personas consist of ethnographic data, which describes the following types of information:

- Personal information
- Technical information
- Relationship information
- Opinion information

Like stated before, the personas are used to go through the intended customer journey. There are several ways described to extend the persona descriptions, by making use of visualisations, or to create extra personas for input. But there are no concrete ways described yet to include extra elements for the optimisation of personas, which then can be used as input for the optimisation of the customer journey. Chapman and Russel (2006) describe that personas have some weaknesses to illustrate and improve descriptions users: The data can be based on empirical data and some info can be irrelevant.

To define new contextual aspects in the persona, it is necessary to define these and to give arguments why these aspects are relevant to include to the description, without making the description too specific for one person instead of a target group.

In the contextual need guidelines, it is possible that based on qualitative and quantitative research, the information in the personas has to be optimised. Several points of input can be customer interviews, customer reviews, business needs et cetera.
Based on the contextual needs, the characteristics of the persona which is defined by the company to define the intended journey has to be compared with characteristics of the user who goes through the journey. The characteristics which are required to fulfil the optimisation of the contextual need (which is found during research), but are not described in the persona yet, have to be included in the persona description. The included elements are marked with a green colour, to visualise the changes in the persona.

When these new aspects are included, it provides a better understanding of the user (which is normally overlooked in Software Engineering) and it enriches the requirement engineering analysis due to a more detailed specification (Castro, Acuna, & Juristo, 2008).

3.6.2. Personal Contextual Requirement Engineering Framework

After the contextual needs are defined, requirements can be realised to include in the customer journey and the architecture. A functional requirement describes the goals which satisfy the users that are interacting with the process or which are making use of an application (Robertson & Robertson, 2012). When describing requirements for a customer journey, it would be useful to categorise the requirements categories to show the level of importance: is it overall, is it for a group or is it personal? To describe and categorise these requirements in this way, the Personal Context Requirements Engineering Framework (PC-RE) can be used. This framework separates the requirements into three categories:

- **Stakeholder group requirements** - describe the cultural elements in business processes which can be used to adapt a system or an application to a user. This means that the design, interfaces and architecture can be customised based on the contextual aspects of a user. Aspects which can be taken into account are the culture, localisation, interaction language, style and functional requirements.
- **User characteristics requirements** - describe the individual skills and abilities of a user which can influence the way how a user interacts with a system or an application. Aspects which can be taken into account for the user characteristics are the physical context of the user, the way of communication, functional requirements and the social context of the user. The location is also a factor which can influence the way of working.
- **Personal goals** - describes requirements from an individual viewpoint. These requirements are mainly used and described for applications where personalisation of individual services is important. Examples are learning & training applications, personal knowledge management services et cetera. The personal goals can be affected by social settings and the localisation of the user.

After the requirements are defined for the new defined contextual aspect, it is possible to search for a solution and check what the impact is in the customer journey and the architecture.

3.6.3. Contextual need guidelines

To define the contextual need, the following steps are required:

1. Analyse the input

Several types of input can lead to changes/improvements in the customer journey and the descriptions of personas:

- *Business needs:* Based on the mission and vision of the organisation, a business can decide which contextual aspects have to be taken into account to improve the journey/experience of a user
- *Interviews/reviews:* Based on interviews (structured or unstructured) and reviews (positive and negative), problems/requests can be found, which are occurred by the users of the journey.

- *Journey problems:* A problem which has to be solved in the journey. If not, the risk exists that users goes to other organisations to fulfil their need(s).
- *Journey alignment:* Alignment over multiple journeys to support the same contextual aspects through the complete journey of the user
- *Comparison of personas with reality:* compare the elements on the persona with elements of a real user (also known as the 10+ UX description). Check which elements can be useful to include in the persona to improve the experience of the user

Analyse from one or multiple input(s) the contextual needs to include in the journey

2. Define contextual problem/need

Based on the analysis of the input(s), define the contextual problem/need which has to be solved for the customer journey.

3. Define requirements

Based on the analysis and the definition of the contextual problem/need in step 1 and 2, define the requirements. To define the requirements, take the following steps:

1. Define contextual requirements: Define the requirements which are required to solve the problem/need. Include a code (like R1-R2 etc.), to make the requirement easier to trace.
2. Categorise requirements: When the list of requirements is defined, structure the requirements by categorising them. Categorise the requirements in the following categories:
   - *Stakeholder group:* Requirements for a complete user group
   - *User Characteristics:* Requirements for users with specific characteristics. These characteristics contain more than one aspect (compared to the stakeholder group)
   - *Personal goal(s):* Requirements which help to achieve specific goals of the user(s)
3. Describe possible solutions: After defining and categorising the requirements, define possible solutions which can realise the support of the requirements in the customer journey.

The above stated steps should be structured in the following way

Table 5 Structure requirements

Category	Functional requirement	Temporal change
Stakeholder group		
User Characteristics		
Personal goal(s)		

4. Update persona

Based on the requirements and the temporal changes described in step 3, update the persona that the contextual aspect can be included. To realise this, the following steps are required:

- Define for the persona (which is used for testing the intended customer journey) which specifications are required to fulfil the described requirements to include the new contextual aspect.
- When information is not included in the persona yet, update the description of the persona by including the new specifications.
- To highlight which information is used to fulfil the new contextual aspect and which information is added to the persona, we add a traceability mark to it. Give the information which is used a green traceability colour/mark

An example of adding new contextual aspects in the persona and making them traceable is given in Figure 22.

Figure 22 Update persona, including traceability

In our running example, the contextual need guidelines steps are described. Like stated in the beginning, the main problem which Studify sees from reviews and from a business perspective, is that they do not take into account of a student what they are studying at which university. Due to this fact, Studify cannot give recommendations of software and a list of study-specific required software. This results in that students do not like the recommendations and that they buy their software somewhere else.

To realise the new contextual aspect, the contextual need for Studify is defined:

1. Analyse the input
Based on the analysis of the reviews of students the following aspects can be found:
- Students do not get recommendations based on the study which they are following
- Students do not get a list of study-specific required software

These points result in a more negative experience, which results in that the students buy their software somewhere else. The analysis is also not in line with the mission and vision of Studify to deliver a website where students buy their software cheaper in an easy way.

2. Define contextual problem/need
Based on the analysis is found that study specific elements are missing. Based on this finding can the contextual need be defined: The study-specific elements have to be taken into account. At the moment is only the university where the student is studying taken into account.

3. Define requirements
Based on the contextual need defined in step 2, and the analysis in step 1, define requirements which are linked to the contextual need

1. Define contextual requirements: To include the new contextual aspect, the following requirements are realised:
   R1: As a student, I want to specify the study which I am following
   R2: As a student, I want to have an overview of the software needs of the study
   R3: As a student, I want to get a top 5 recommendations of most important software during my study.

2. Categorise requirements: After the definition of the requirements, the requirements have to be categorised between the 3 categories. R1 and R2 are specific for groups of students. Students want to specify their study and receive an overview of required software for their study. R3 can contain more user characteristics. This requirement does not directly count for students who do not want to receive recommendations.

3. Describe possible solutions: After categorisation, possible solutions can be described for the requirements. These can be as followed:

   R1: Registration of study in registration, registration of study in options
   R2: List of software, based on study and university, defined by the university
   R3: Option to enable recommendations, list based on most bought by students with the same study/university

After the three steps are fulfilled, they are structured in a table:

Category	**Functional requirement**	**Temporal change**
Stakeholder group: students following a study at a university	*R1:* As a student, I want to specify the study which I am following at a university *R2:* As a student, I want to have an overview of the software needs of the study	*R1:* Registration of study in registration, registration of study in options *R2:* List of software, based on study and university, defined by the university
User Characteristics: Students who asked for study-specific recommendations	*R3:* As a student, I want to get a recommendations of most interesting software based on my study.	*R3:* Option to enable recommendations, list based on most bought by students with the same study/university

Personal goal(s)	Not defined	Not defined

4. Update persona

To include the new aspect of the study, the persona has to be updated. The university is already available, but the study is not specified. The list of studies can be filtered, based on the university a student is studying at. In the persona of Kate (see Figure 23), the Study element is included. To make the changes traceable, the study element is highlighted in green.

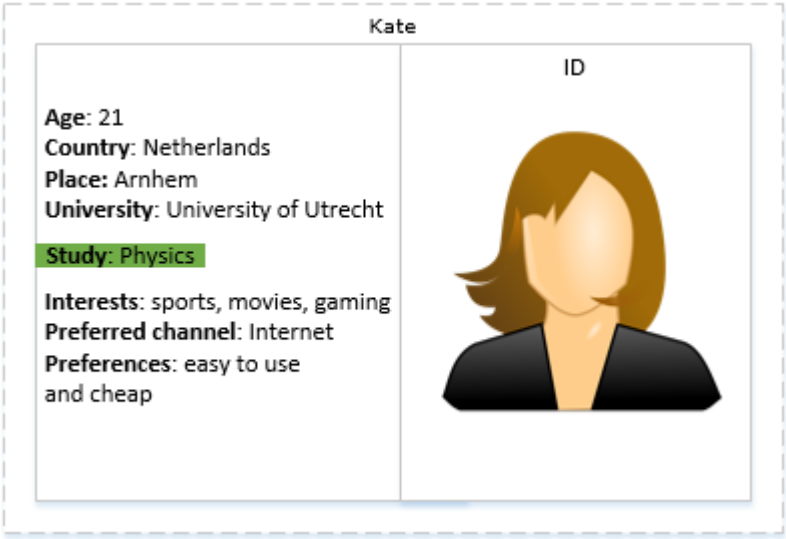

Figure 23 Running example Persona

3.7. Traceability/impact management Technique

When the intended architecture is defined and the changes in the customer journey (based on the event logs/contextual need) are described, it is possible to show what changes in the touchpoints of the customer journey and the architecture before it is even implemented. These changes can be seen as the assessment of the impact of changes. The changes in the strategy of an organisation and the business goals, can have a large impact on the structure of the organisation, business processes and the underlying architecture (Boer, et al., 2005). The goal of an impact analysis is to check what happens when a change occurs, before the change is implemented. This analysis can help to decide in the need for a change (Arnold, 1996) .

When describing the changes in customer journey and architecture, it is not only important to describe the changes and what the impact is of these changes. It is also important to make them traceable and visualise them. Requirements traceability is the ability to describe and follow the life of a requirement from its origins until its deployment and refinement (Gotel & Finkelstein, 1994). Requirements traceability saves effort and can improve the maintenance quality of software (Mäder & Egyed, 2015). By visualising the traceability of the requirements, characteristics, patterns and trends can be discovered, due to the large amount of information which is visualised (Gershon, Eick, & Card, 1998).

The requirements which are used in the contextual customer journey process, should specify improvements in the customer interaction and the systems which are used within the organisation. These requirements should support the business principles (Braun & Winter, 2005).

Several methods are described to make use of visualisation and traceability of requirements. Methods like the traceability matrix, traceability graph, lists and hyperlinks are used to trace requirements (Li & Maalej, 2012). But these methods do not give direct insights in the impact when new aspects are implemented or new requirements are required. Lankhorst (2017) makes use of the Impact Analysis tool to show which elements in the architecture are impacted by a change in the models. He describes that based on this analysis type, enterprise architects can better validate the correctness of the models, enrich their model descriptions and reduce the misinterpretations in the models.

Colour traceability can be used to visualise the changes based on the event logs or the new contextual aspect. The Colour traceability guidelines, which are described in 3.7.1, can be used to indicate the changes on each level. By making use of these guidelines, the impact can be described in each level of the architecture and also can be traced by making use of colour traceability which elements are impacted by the changes based on the event logs or the contextual aspect. Instead of one colour, like the impact of change analysis tool of Lankhorst (2017) is using, we make use of two colours: one for the event log changes and one for the contextual aspect changes. In this way, we enable categorisation in the traceability of the changes.

3.7.1. Colour traceability guidelines

1. **Describe the changes in the customer journey (touchpoints) –** Describe the changes in the touchpoints based on the new contextual aspects in the customer journey or changes in the journey analysed from the event logs. A new contextual aspect does not directly mean that the customer journey is affected. If this is the case, go to step 2.
    a. **Describe affected touchpoints –** Describe for the customer journey which touchpoints are affected by the new contextual aspect. Describe what changes in the touchpoint
    b. **Describe new touchpoints -** When a new contextual aspect is used in a customer journey, it is possible that new touchpoints have to be realised to support the new contextual aspect in the customer journey. If new touchpoints are required, describe what the function of the touchpoint is and where it is included in the customer journey
    c. **Traceability –** Assign the traceability mark/colour to the affected/new touchpoints. Green = new contextual aspect Blue = Event logs

2. **Describe the changes in the business service layer –** Based on the new contextual aspect which has to be included in the journey or based the changes from the event logs, describe which business services are changing or which new business services have to be included in the business services layer. When a new contextual aspect is included, this does not directly mean that the functionality of a business service is affected. When there are no changes needed in this layer, go to step 3.
    a. **Describe affected business services –** Describe for the already existing business services (for the affected touchpoints) how they change
    b. **Describe new business services for existing touchpoints –** When it is not possible to provide the new contextual aspect with existing business services for the existing touchpoints, it is necessary to include new services. Describe for the existing touchpoints the new business services and what services they deliver
    c. **Describe new business services and link existing business services for new touchpoints –** When new touchpoints are realised to include a new contextual aspect in the customer journey, describe which existing business services are needed. Link these business services to the new touchpoint. If a new business service is required, describe the details of the service and what is delivers.
    d. **Traceability –** Assign a traceability mark to the affected/new business services. Green = new contextual aspect Blue = Event logs

3. **Describe the changes in the business process layer -** Based on the new contextual aspect or the changes based on the event logs which have to be included in the customer journey, describe how the steps in the process change or which new process steps have to be included in the business process layer. When a new contextual aspect is included or a new business service is realised, this does not directly mean that the business process is affected. When there are no changes needed in this layer, go to step 4.
    a. **Describe adjustments in the business process –** Describe for the AS-IS business process how the process steps change
        i. **Onstage actions –** Describe the differences for the affected steps how the interaction(s) with the customer change
        ii. **Backstage actions –** Describe how the interaction(s) for the employees who are interacting with the customer(s) change
        iii. **Supporting actions –** Describe what changes in the interactions of other departments within the company which provides information to the employee who is interacting with the customer
    b. **Describe the new business process steps –** Based on the new business services or changes in the business process, it can be necessary to realise new process steps. Check for the onstage, backstage and supporting actions which new actions are required in the process. Describe for each new step the functionality, goals and responsible stakeholder to fulfil the process step.
    c. **Traceability -** Assign a traceability mark/colour to the affected/new business process steps.
    Green = new contextual aspect Blue = Event logs

4. **Describe the changes in the application services layer –** Describe for the adjusted business processes if the existing application services have to be adjusted and if new application services have to be included in the architecture. When there are no changes needed in this layer, go to step 5.
    a. **Describe adjustments in the existing application services –** Describe which application services are affected by the changes due to the new contextual aspect. Describe for the affected application service(s) what changes (new functionality, separation of functionalities et cetera)
    b. **Describe new application services –** When the existing application services cannot realise the new contextual aspects in the business process, it is necessary to provide new application services. For the new application services, describe the functionality of the services.
    c. **Link to business process -** Link the new application services to the existing or new business process steps which they support.
    d. **Traceability –** Assign a traceability mark/colour to the affected/new application services.
    Green = new contextual aspect Blue = Event logs

5. **Describe the changes in the application components –** Describe for the adjusted application services if the existing application components have to adjusted and if new application component(s) have to be included in the architecture to realise the new contextual aspect or the changes based on the event logs.
    a. **Describe adjustment in the existing application components –** Describe which application components are affected by the changes. Describe for the affected application component(s) what changes
    b. **Describe new application components –** When the existing application components cannot deliver the capabilities for the existing and new application services, it is necessary to provide new application components to realise the new contextual aspect or the changes based on the event logs. For the new application component(s), describe
    c. **Link application components –** When new links have to be realised between existing applications, describe what changes in the information transfer between components. For the new application components, link them to the application components where they collaborate with and describe which information is transferred.

d. **Traceability –** Assign a traceability mark/colour to the affected/new application components.
Green = new contextual aspect Blue = Event logs

In the running example for the Colour traceability guidelines, two types of examples are worked out: the changes (including traceability) for the event logs and the changes based on the new contextual aspect. Step-by-step is described how the changes impacts the underlying journey. First, we describe the running example for the event logs, because this step is required earlier in the process.

Changes based on event logs
Based on the change to decrease the average time to receive the e-mail of approval of registration, the guidelines are used. For the event logs, we go directly to step 2, since the affected touchpoint is already described, when making use of the process mining model of Bernard and Andritsos (see Figure 12). In these steps, the blue traceability mark is used to show the impacted elements in the architecture.

2. Describe the changes in the business service layer
Based on the faster receive time of the e-mail, the confirmation service which provides the e-mail touchpoint does not change. The content in the e-mail stays the same when the organisation is interacting with the customer.

a. **Describe affected business services**
No changes are required in the current situation of the business services. The interaction with the customer stays the same.
b. **Describe new business services for existing touchpoints**
No new business services are required.
c. **Describe new business services and link existing business services for new touchpoints**
No new touchpoints are realised.
d. **Traceability**
Traceability not necessary: no changes.

3. Describe the changes in the business process layer

a. **Describe adjustments in the business process**
To improve the speed in the journey, the step of accepting the confirmation is automated. In this way, Studify does not have to accept it manually, while the university already confirmed the registration.
i. **Onstage actions**
No changes required
ii. **Backstage actions**
Accept registration is going to be removed.
i. **Supporting actions**
Send Confirmation Subscription is linked to the Click on activation link business process step.
b. **Describe the new business process steps**
No new steps are required in the business process
c. **Traceability**
The blue traceability mark is given to the adjustments which are done in the business process.

The changes in the business process and the traceability are shown in Figure 24.

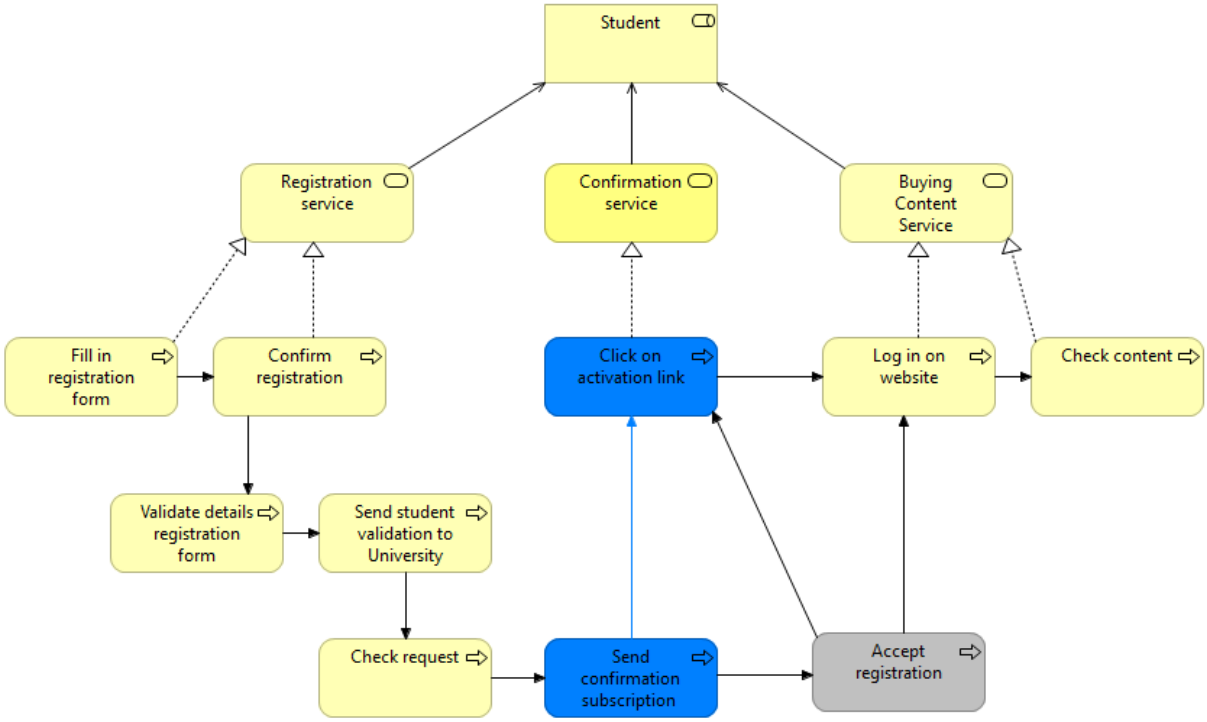

Figure 24 Running example Event log business process changes

4. Describe the changes in the application services layer

a. **Describe adjustments in the existing application services**
The E-mail application service is adjusted. Instead of sending an e-mail to an employee of Studify, which sends the acceptation, the confirmation is automatically accepted by the E-mail service and the Activation link is send to the student.
b. **Describe new application services**
No new application services are required
c. **Link to business process**
The improved e-mail service is linked to the Send confirmation Subscription business process step.
d. **Traceability**
The blue traceability mark is given to the adjustments which are done in the application services.

The changes in the application services and the traceability are shown in Figure 25.

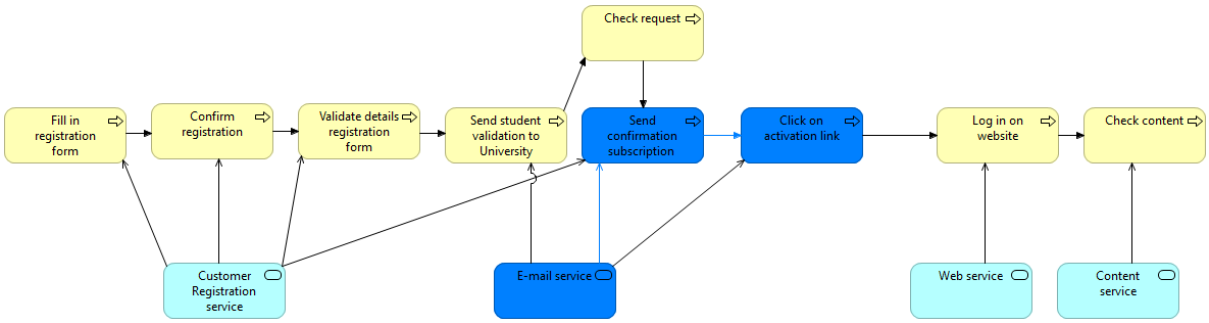

Figure 25 Running example Event log application services changes

5. Describe the changes in the application components

In this step, the e-mail automation for Studify is included in the application components layer

a. **Describe adjustment in the existing application components**

The WebSphere application component is being adjusted. The application component can be extended by implementing a script to check an application. When the application is fulfilled, an e-mail is send.[3]

b. **Describe new application components**

No new application components are required to realise the e-mail automation

c. **Link application components**

No new links are required

d. **Traceability**

The blue traceability mark is given to the adjustments which are done in the application components (WebSphere).

The changes in the application components and the traceability are shown in Figure 26.

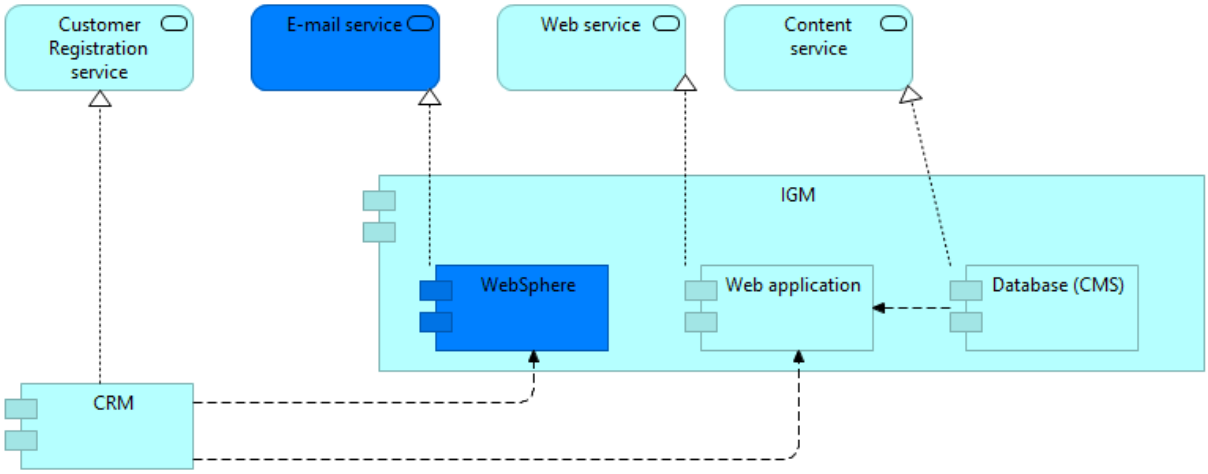

Figure 26 Running example Event log application components changes

Changes based on contextual need

The steps describe how the new elements (option to define study, list of software for study and software recommendations) are implemented and what the impact is in each layer.

1. Describe the changes in the customer journey (touchpoints)

Based on the new elements which are included, based on the contextual needs, two touchpoints are affected: the registration page and the homepage. The registration page gets two additions: the possibility to describe the study and the possibility to enable recommendations for the study. The homepage gets two new elements as well: The list of software based on the study and the list of recommendations (based on if the option is enabled in the registration. Elements could also be added to an options page (enable recommendations), but this touchpoint is out of scope for this description. To show that the registration and homepage touchpoint are affected by the new contextual aspect, assign the green traceability mark to it. An example is given in Figure 27.

[3] https://www.ibm.com/support/knowledgecenter/en/SSZLC2_8.0.0/com.ibm.commerce.integration.doc/refs/rcvsilverpopsampleemails.htm

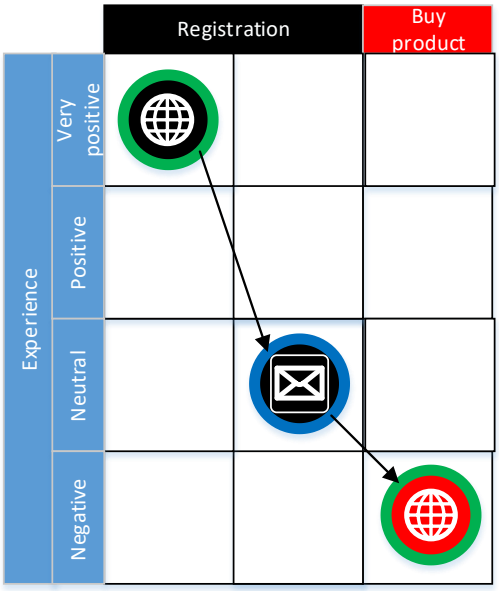

Figure 27 Running example traceability contextual need touchpoints

2. Describe the changes in the business service layer

a. **Describe affected business services**

The Registration service is affected, due to the fact that the customer (student) has to describe the study which they are fulfilling at the university. The buying content service is also affected, due to the list of recommendations which is shown to the customer.

b. **Describe new business services for existing touchpoints**

No new business services are required. The existing business services are improved

c. **Describe new business services and link existing business services for new touchpoints**

Not required.

d. **Traceability**

The green traceability mark is given to the adjustments which are done in the business services.

The changes in the business services and the traceability are shown in Figure 28.

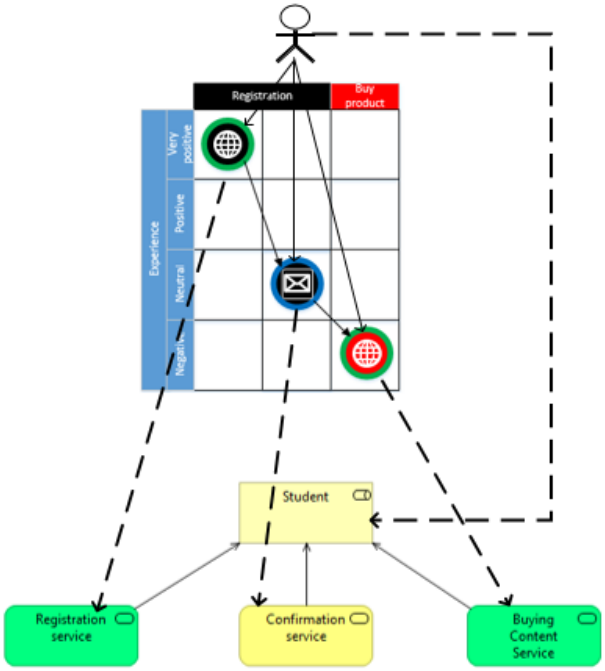

Figure 28 Running example Context business service

3. Describe the changes in the business process layer

a. **Describe adjustments in the business process**

The changes in the registration service and the buying content service leads to several changes in the business process layer

i. **Onstage actions**

The Fill in registration process step is going to be improved. The customer (student) has to fill in extra their study and they have to enable or disable to receive recommendations on the home page.

The Check Content process step is changed as well. The student sees a list of software which they have to buy for their study. Based on the given options in the registration, the student receives recommendations about software they have to buy.

ii. **Backstage actions**

The validate details registration form process step has to be extended with the check for the study and the recommendations

iii. **Supporting actions**

The Check request process step is going to be improved. The university has to check if the student, which is registered on the website, is fulfilling the study at the university. If this is the case, they can go further to the send confirmation step.

b. **Describe the new business process steps**

No new steps are required in the business process

c. **Traceability**

The green traceability mark is given to the adjustments which are done in the business process.

The changes in the business process and the traceability are shown in Figure 29.

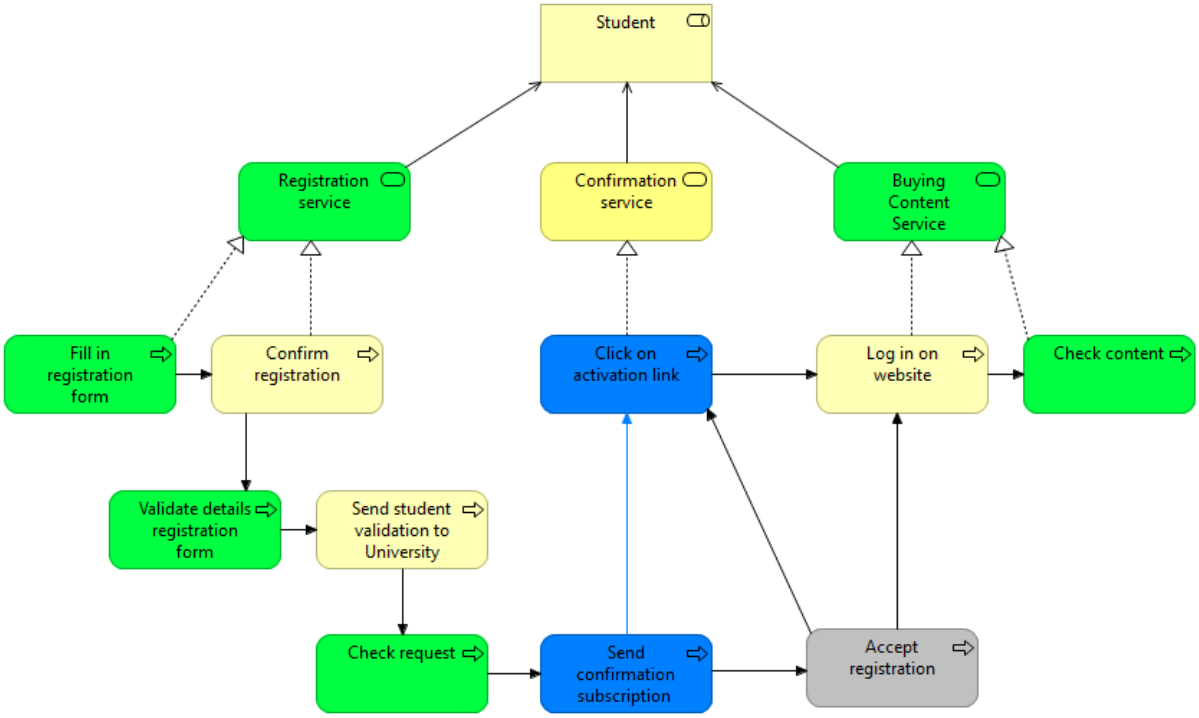

Figure 29 Running example Context business process

4. Describe the changes in the application services layer

a. **Describe adjustments in the existing application services**

The customer registration service is adjusted. The option to select the study has to be included and it should be possible to enable or disable recommendations.

The Content Service is also improved. It includes a list of software which is related to the study of the customer (student).

b. **Describe new application services**
A new application service is included. The recommendations service provides in the Check content process step the recommendations, when a customer (student) has enabled it in the options menu.
c. **Link to business process**
The recommendations service is linked to the check content business process step.
d. **Traceability**
The green traceability mark is given to the adjustments which are done in the application services.

The changes in the application services and the traceability are shown in Figure 30.

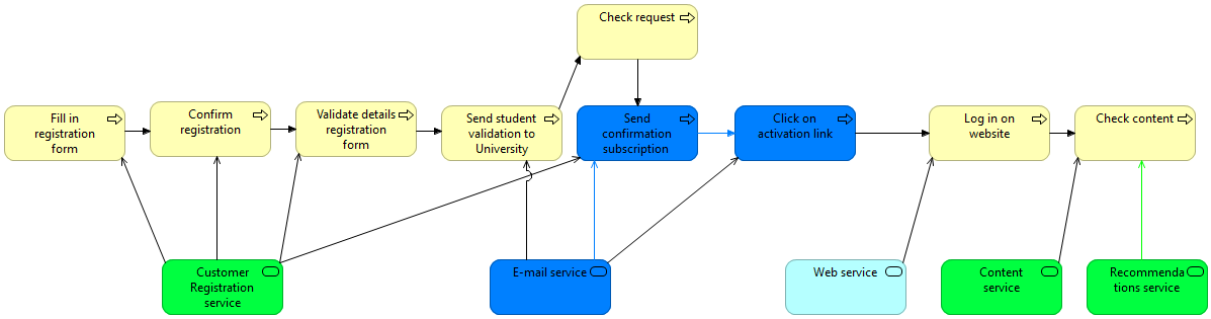

Figure 30 Running example Context application services

5. Describe the changes in the application components

a. **Describe adjustment in the existing application components**
The CRM application component is improved by realising extra fields: Study and Recommendations. The database includes some new study elements like which software is used for which study? The web application is extended by making use of the recommendation engine realised by IBM[4]. In this way, study-related recommendations can be given
b. **Describe new application components**
No new application components are realised.
c. **Link application components**
Several new links are set to application components: From CRM to Database (CMS), to realise study specific lists and recommendations for students. The link between Database(CMS) and Web application are also improved, to realise the recommendations engine.
d. **Traceability**
The green traceability mark is given to the adjustments which are done in the application components.

The changes in the application components and the traceability are shown in Figure 31.

By making use of these steps, the requirements which are realised from the Contextual need guidelines (include study-aspect, study-specific software list and software recommendations) and the changes from the event (improve speed of e-mail confirmation) are covered in the architecture.

[4] https://www.ibm.com/developerworks/websphere/techjournal/1109_zegarra/1109_zegarra.html

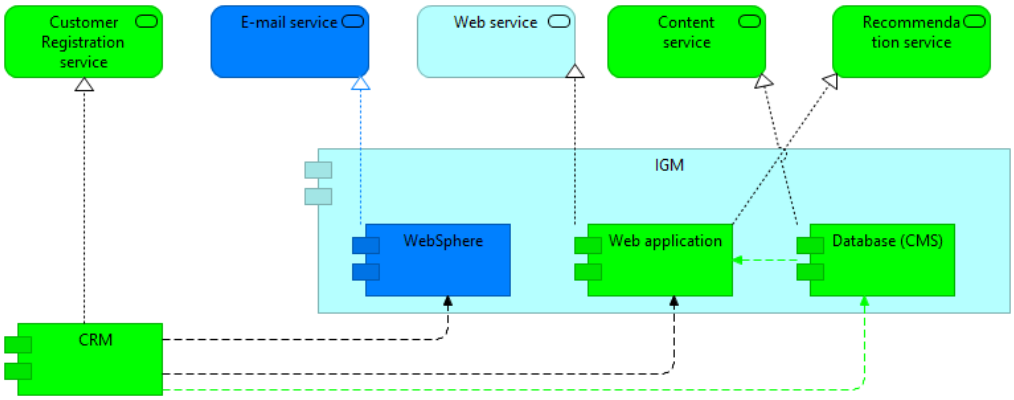

Figure 31 Running example Context application components

3.8. Summary

This chapter describes the principles of the contextual customer journey process. The main goal is to describe how an organisation can include contextual aspects in their customer journey and how to translate these into the enterprise architecture (focus on the business and application layers). To realise this goal, the contextual customer journey process is realised. This process consists of 8 steps which deals with the following requirements:

- **R1** - A step-by-step process description should be established to facilitate the use of the process
- **R2** - The user experience should be analysed in a systematic way to design an optimal customer journey
- **R3** - The contextual aspects of a user should be elicited, described and realised in order to provide a TO-BE customer journey which supports contextual aspects
- **R4** - Guidelines are required which will help in the facilitation of the implementation of architectural aspects for the TO-BE customer journey, i.e. business services, business processes, application services and application components.
- **R5** - Explicit traceability between the customer journey and the enterprise architecture should be supported.

The contextual customer journey process consists of 8 steps. To fulfil the requirements, the process takes the following aspects into account:

- How to align the customer journey with the enterprise architecture?
- How to include process mining improvements in the customer journey?
- How to align the process mining improvements in the customer journey with the enterprise architecture (traceability)
- How to define the contextual need
- How to take new contextual needs from a customer/user into account
- How to include contextual aspects in the customer journey
- How to align the contextual aspects improvements in the customer journey with the enterprise architecture (traceability)

4. Treatment Validation

The main goal of the validation is to test the contextual customer journey process in conditions of the real world. We want to see if the ideal descriptions and steps made in the process are applicable in the conditions of practice that occur in the real world. The contextual customer journey is defined based on theoretical descriptions and interviews from a practical perspective with employees from the banking business.

To bridge the gap between the theoretical framework and real world practices, we apply the contextual customer journey process in the context of the Dutch bank ContextBank. ContextBank has the need to include the multilingual context into their customer journeys. By making use of the contextual customer journey process, it is possible to include the multilingual context in a structured way. The contextual customer journey process can be applied in the real-world environment by applying it in the use case of ContextBank.

We conduct a technical action research project to evaluate the process tin the context of ContextBank. Next to the observational analysis (exploratory, descriptive or explanatory research), the researchers implicate in the organisational improvement, while applying the contextual customer journey process.

We focus on the "become an online customer" journey in the use case of ContextBank, which is the customer journey to open a payment account and/or a savings account. The objective is to validate the contextual customer journey process in the conditions of the real world. During the validation process of the contextual customer journey process (by use of the technical action research method), we want to know how the process can help to include contextual aspects in a structured way into a customer journey. Next to the application, we want to discover the practical interpretations of the practitioners in the case of ContextBank by answering research questions.

After the action research is fulfilled, we collect data which is used as evidence for the conclusions.

4.1. Research method

Based on the research method described by the technical action research protocol (Wieringa & Morali, 2012), the research is structured in three cycles: Two engineering cycles (one engineering cycle for the contextual customer journey process and one cycle for the application of the contextual customer journey process in the ContextBank case) and one research cycle (the validation of the contextual customer journey process in the ContextBank case) (see Figure 32). In this technical architecture project, we observe the effects of the application of the contextual customer journey process on the "become an online customer" process of ContextBank.

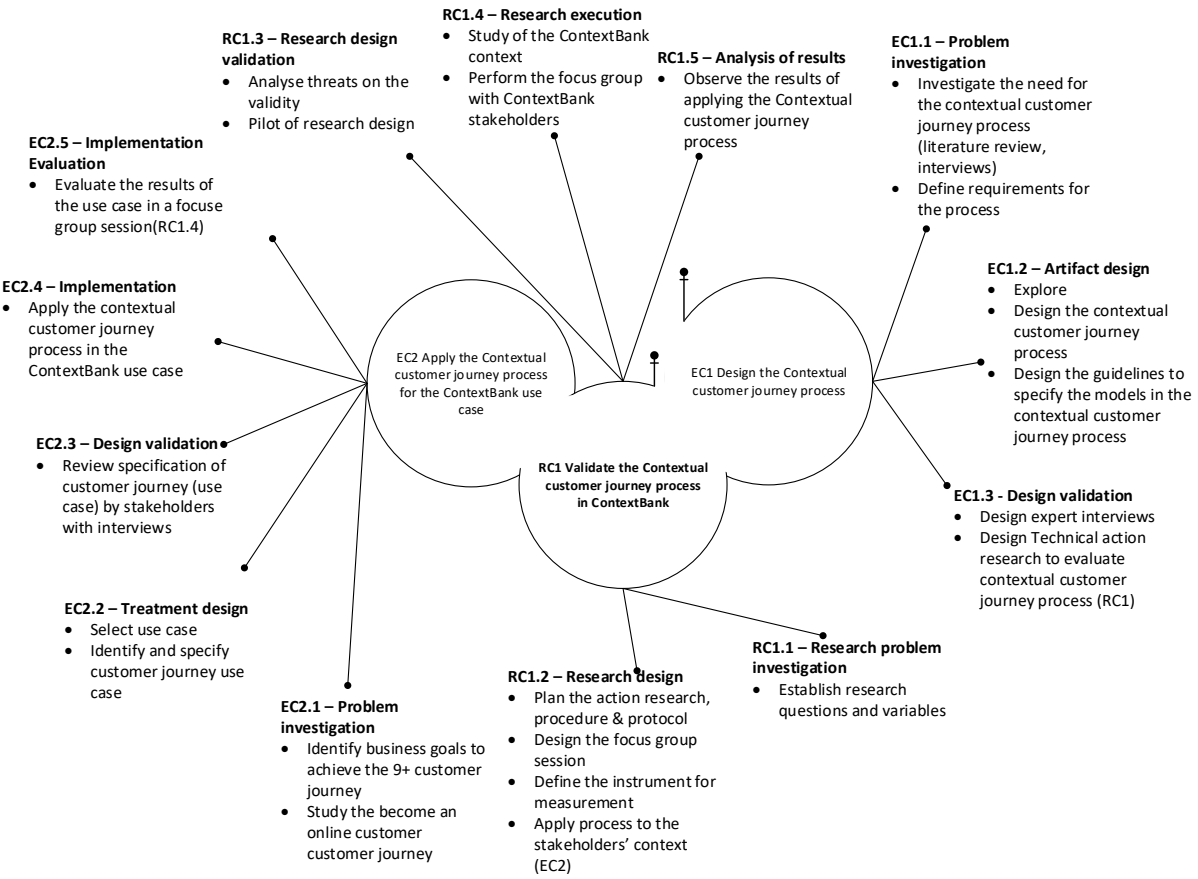

Figure 32 Overview of the technical action research methodology, which is used for the validation of the contextual customer journey process in the ContextBank use case

4.1.1. Action research design

Based on the treatment validation has to be confirmed or rejected if the contextual customer journey process is useful in real world practices. Based on this aspect, we define research questions and they will be confirmed or rejected based on the results of the validation.

4.1.2. Research questions

In the following section, we formulate the research questions. For each of the research questions, we define how we gather data to answer the question. To evaluate the contextual customer journey process, we support the evaluation by making use of a theoretical framework for the research questions. In this way, requirements and measurements are possible in a structured and defined way. For the evaluation (and variables), we make use of the following frameworks: The Method Evaluation Model (also known as MEM) by Moody (see Figure 33) and the GOMS model by Card, Moran and Newell.

The overall approach to answer the research questions is based on interviews and discussions with stakeholders from the ContextBank and their observations when they interpret the results for the use case while using the contextual customer journey process. By making use of additional/extra methods for data collection, we create triangulation.

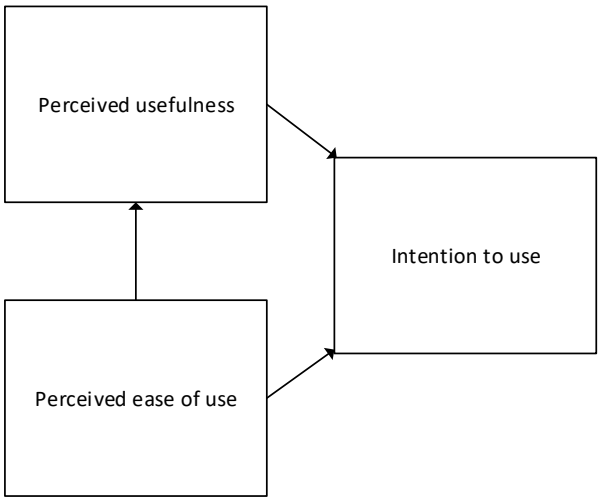

Figure 33 Method Evaluation Model (Moody, 2003)

RQ1 What is the perceived usefulness of applying the contextual customer journey process?

Next to the evidences from interviews, discussions and observations, we plan to assess the perceived usefulness of the contextual customer journey process. The perceived usefulness (V1) is the degree to which the stakeholders consider that the process is effective in achieving its intended objectives. This is done by checking the results of the contextual customer journey process and how these have a meaningful interpretation for the stakeholders of ContextBank. To measure the perceived usefulness, the stakeholders have to fill in the MEM questionnaire (MEM questionnaire consists of questions with a 5-point Likert scale, based on the MEM descriptions of Moody (Moody, 2003)) and we have a brainstorm session about the opinions.

RQ2 What is the perceived ease of use of applying the contextual customer journey process?

Next to the evidences from interviews, discussions and observations, we plan to assess the perceived ease of use of the contextual customer journey process. The perceived ease of use(V2) is the degree to which stakeholders consider that using the method would be free of effort.

This is done by checking the results of the contextual customer journey process and how these have a meaningful interpretation for the stakeholders of ContextBank. To measure the perceived usefulness, the stakeholders have to fill in the MEM questionnaire and we have a brainstorm session about the opinions.

RQ3 What are the interpretations about the results of the contextual customer journey process artefacts?

For this research question, the results of the contextual customer journey process have to be interpreted by the stakeholders of ContextBank. In this way, the results will be discussed and conclusions can be made about how stakeholders interpret the results of the process. To investigate this, we use the following elements of the GOMS model (Card, Newell, & Moran, 1983):

- Goals (V3) **–** What do the stakeholders intend to accomplish
- Operations (V4) **–** What are the actions performed to reach the goal
- Methods (V5) **–** Sequences of operators to reach the goal

RQ4 What kind of practical applications within ContextBank would the stakeholders envision for the contextual customer journey process?

We consider as researchers that the contextual customer journey process can be useful in the context of ContextBank to include contextual aspects in a customer journey to make the

journey to improve the customer experience. However, the stakeholders of ContextBank can have different intentions to use this process. To investigate this, we measure the intention to use. The intention to use (V6) is the degree to which stakeholders intend to adopt the process.

To measure the intention to use, the stakeholders have to fill in the MEM questionnaire. We also brainstorm about when the contextual customer journey process can be used.

The structure of the goal, research questions and variables is shown with a GQM model (Solingen & Berghout, 1999) in Figure 34.

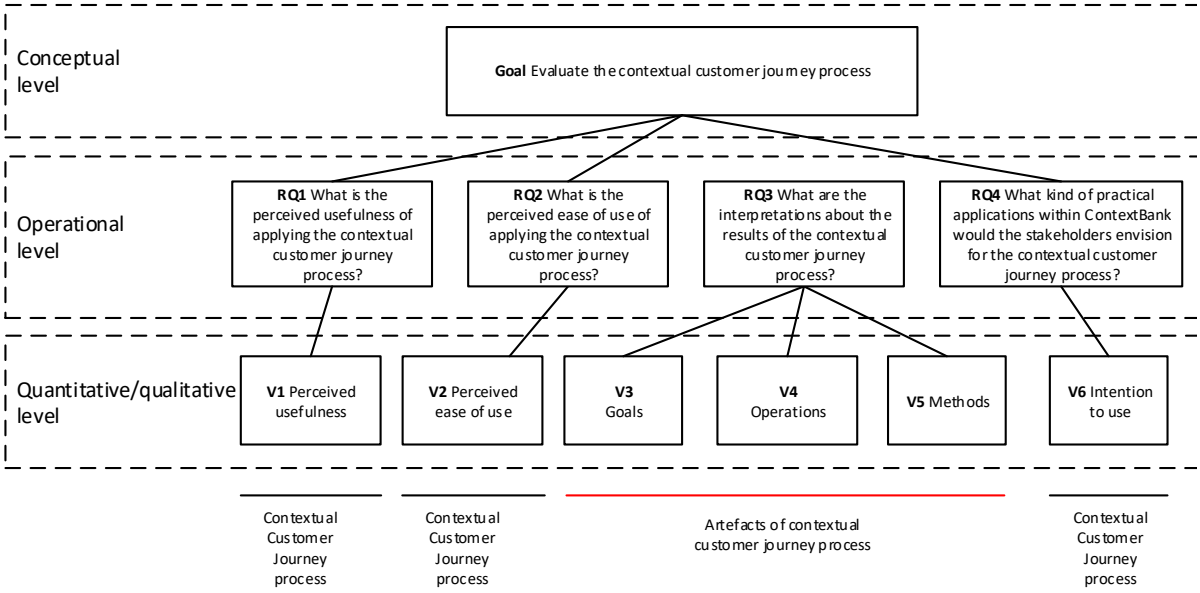

Figure 34 GQM model

4.2. The ContextBank case and the unit of analysis

ContextBank is a bank that belongs to the banking sector in the Netherlands. ContextBank operates a software eco-system of applications to support their information systems. This eco-system is used by multiple organisations and delivers all types of services for Sales/Buying processes, service processes, marketing, bannering et cetera. ContextBank uses this eco-system for communication with their customers. Typical bank customers are individuals and businesses. To let customers communicate with the bank, they make use of services of this eco-system. One of the main goals of the bank is to provide their customers the most complete and ideal customer journey. The journey should be attractive and relevant. The main goal for the bank is to deliver a smooth 9+ out of 10 customer journey. In beliefs of the bank, the 9+ out of 10 journey is the only way customers remains or becomes customer at a financial services provider. Products become commoditised, and margins drop on commodity products. The 9+ out of 10 customer journey can be achieved by tuning applications, data and services to each other. Based on an interview with a business architect at ContextBank, they indicated that for example not all pages on the website are completely translated: There is a separate page describing the main aspects of the bank in the English language. To improve their customer journey, ContextBank wants to facilitate communication with customers by means of multilingual support. By realising this aspect, the bank gets a multi-lingual system, which adapts language based on preferences of their customers. In this context, the eco-system should consider modern expectations from all types of users, young and elderly people, banked or unbanked, digital natives or not, thereby focusing on the most relevant customer journey for all interactions and processes with customers on all relevant channels.

The Dutch translations of text are checked at the ContextBank. When the ContextBank wants to implement support for different language, the department has to check these translations

by themselves, which takes more time. The ContextBank has a need to implement multilingual support to improve the customer experience.
The main question for the bank is how an application architecture for the multi-lingual customer journey looks like. For this, it is vital to have a holistic approach where the architecture needs to be defined using standards, organisational processes, and customers' preferences. To solve this question, we plan to explore the customer journey mapping model by Bernard et al. and to apply process mining techniques to extend their proposal to support the realisation of a multilingual application architecture.

4.2.1. Unit of analysis: Registration journey (Become an online customer)

The customer journey, which is used to include multilingual aspects at ContextBank is the registration journey. When a user fulfils the touchpoints of this journey, they have opened a payment/savings account and they receive a payment card. During the registration, users have to fill in their personal details, take a picture of their ID, sign the agreement and fulfil a payment.
The main problem for the registration journey is that the Dutch translations in the mobile banking application of ContextBank are well described. When the user wants to switch to the English translation, the user will only see a partly translated Home screen (a combination of the Dutch and English translation) and it is not possible to fulfil the registration journey in English.
This action research can be characterised as a single holistic study, with an overall case (ContextBank) and one unit of analysis (become an online customer).

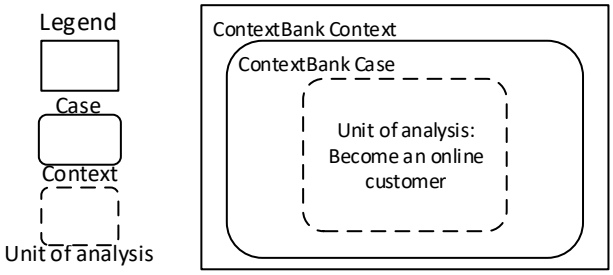

Figure 35 Design of the single holistic case study for the ContextBank use case

4.3. Methods for data collection

4.3.1. AS-IS and TO-BE models for Become an online customer

Several stakeholders provided the researchers with information, documentation to describe the initial situation of the become an online customer journey. The researcher extended this customer journey step-by-step to the TO-BE situation, including a new contextual aspect. The worked-out version of the use case can be found in Appendix A: Use case.

4.3.2. Collect interpretations and perceptions from stakeholders about the process

The method to collect data for the interpretations and perceptions is the focus group. We gather information by making use of questionnaires and free expressions for perceptions and interpretations.
The focus group is chosen as validation method, due to the fact it is very useful for the qualitative research. Due to the fact that the participants in the focus group have different backgrounds (1 UX-designer, 2 Business analysts and one innovation manager), they can create new insights from different views. In this way, it facilitates in the discussion if elements in the contextual customer journey process are efficiently designed. Due to the different views of the participants and the relaxed environment where the focus group takes

place, they can discuss and compare their points of view around the process. In this way, the participants also increase their perspective around the discussed topics. These perspectives can be used in practice, which will lead to a business benefit.

4.3.3. Adaptation of MEM to the ContextBank case and information gathering

We apply the MEM framework to answer RQ1, RQ2 and RQ4. The researchers will register the perceived usefulness, perceived ease of use and the intention of use by means of a 5-point Likert scale questionnaire. This questionnaire is based on the MEM framework and consists of 15 questions.

4.3.4. Adaptation of GOMS to the ContextBank case and information gathering

We apply elements of the GOMS model to answer RQ3. The researchers will prepare a presentation to present the initial situation of the ContextBank use case, the contextual customer journey process (including the artefacts) and the TO-BE situation of the ContextBank use case. Based on these elements a discussion will be held around the interpretation of each artefact. For each artefact, we discuss the goal, operations and methods with the stakeholders. To register the interpretations, a recording machine is used to record the focus group session.

4.3.5. Post-it session for the practical application of the contextual customer journey process

During the focus group, 3 post-it sessions are held to increase the input for answering RQ1, RQ2 and RQ4. For RQ1 and RQ2, the stakeholders of ContextBank give input about their thoughts and possible improvements. For RQ4, the stakeholders will specify possible practical applications where they can use the contextual customer journey process. These post-its facilitate will facilitate in the discussion.

4.4. Procedure

4.4.1. Process steps

Figure 36 describes the process steps for the data collection.

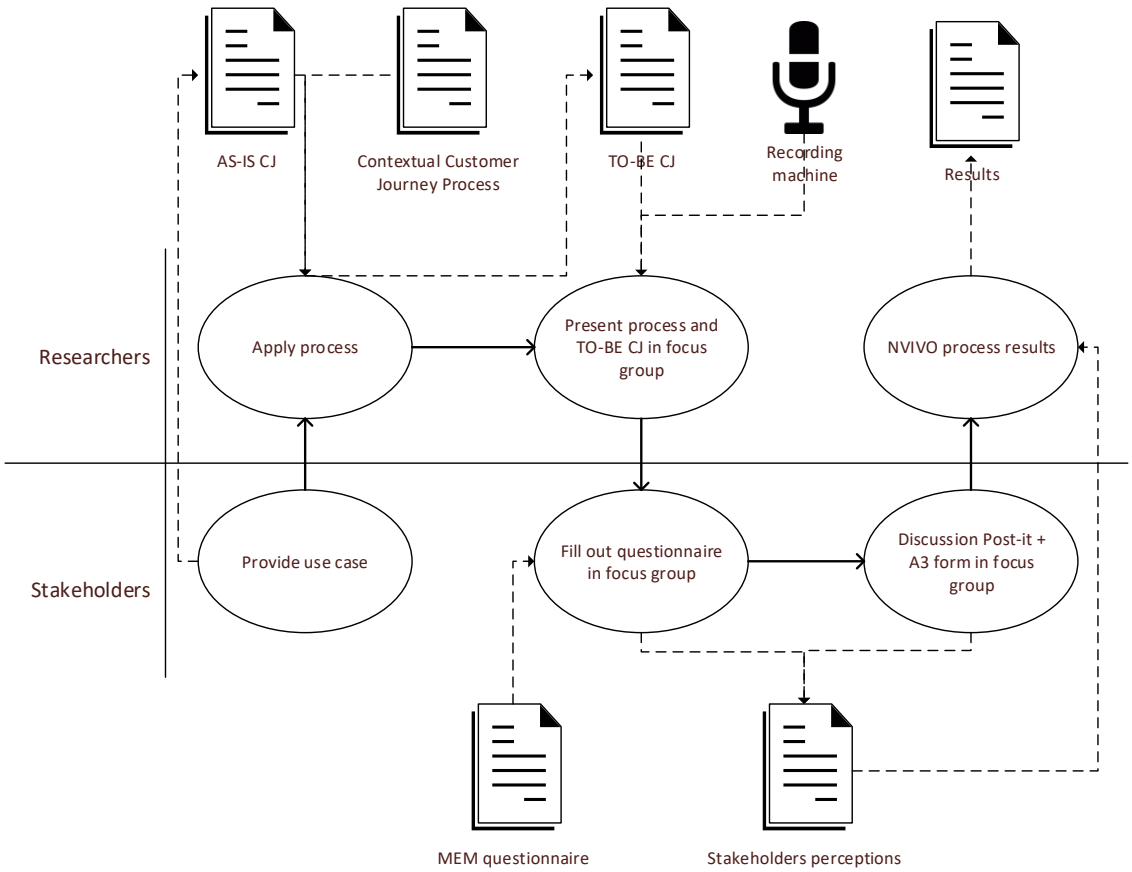

Figure 36 Procedure for data collection

4.4.2. Schedule

The session is performed in a meeting room in the ContextBank. We set up a nice and relaxed environment for the stakeholders of ContextBank. Due to the fact that the stakeholders work in the same building as where the meeting room is located, it will be a comfortable place for them. The performed activities during the focus group are specified as followed:

Table 6 Schedule

Activity code	**Description**
FG1	Presentation of the focus group session. The objective of the focus group is described and an agenda is given to show the schedule of the focus group
FG2	Presentation of the initial situation of the become an online customer journey at ContextBank including problem statement
FG3	Presentation of the contextual customer journey process. Give the participants descriptions of the guidelines (see appendix D, appendix E and Appendix F) to go through the process
FG4	Presentation of the TO-BE results use case of the become an online customer journey
FG5	The focus group participants of ContextBank fill out the MEM questionnaire.
FG6	Post-it session + discussion perceived usefulness
FG7	Post-it session + discussion ease of use
FG8	For each artefact in the contextual customer journey process, the focus group participants of ContextBank will express their interpretations
FG9	Post-it session for future application of contextual customer journey process

4.5. Validity and ethical issues

To increase the strength of the validation in the action research, we take several types of triangulations into account (provide a broader picture for the action research of the ContextBank use case by looking at multiple perspectives):

- Data source triangulation: four participants of ContextBank with different backgrounds will be part of the action research (focus group)
- Observer triangulation: The researchers are involved in all the phases of the action research (design, execution and data analysis)
- Methodological triangulation: Different types of data collection methods (qualitative and quantitative) are used.

Four kinds of threats were addressed in the research project: Conclusion validity, construct validity, internal validity and external validity

4.5.1. Conclusion validity

Conclusion validity is about the threats that concerns issues, which affect the ability to draw the correct conclusions.

The first conclusion validity threat is the poor use of the statistical tool. This is when the statistical power of the research is low (not enough participants for quantitative research, to describe results with statistics). Due to the fact that the method used in this research project is qualitative, we consider that this threat does not apply here.

The second threat for conclusion validity is violated assumptions. We assume that stakeholders are free to say anything in the focus group. But when they are not, you can get responses that are not real or miss the responses that are real. To reduce this risk, the focus group is held within ContextBank with Stakeholders of ContextBank with voluntary participation.

The last threat is triangulation. The answers that are not fully shown from multiple perspectives cannot be considered as valid. This does not directly mean that answers are valid when triangulation shows consistency.

4.5.2. Construct validity

Construct validity is about the generalisation of the results around concepts or theories which are used in the contextual customer journey process. This can be based on the design of the focus group or social factors.

- *Inadequate explanation of methods/guidelines of the process*: we check in a pilot if the methods/guidelines are well defined and explained in the presentation. By asking junior and senior researchers if they see the structure, the questions and which elements are measured. They can state if slides are underspecified, over-specified, inconsistent, incomplete, et cetera.
- *Mono-method bias:* Using a single type of measurement gives the risk of a measurement bias. That is why we have decided to involve multiple types of measurements. We have the recording session of the focus group when the participants analyse the use case of ContextBank. In addition, we have the MEM questionnaire, the GOM discussion and the post-it sessions as input for the discussion.
- *Restricted generalisability:* To reduce the risk that artefacts affect each other (which leads to generalisability), the analysis will not only take the main treatment into account, but also the side-discussions (which can be useful as input).
- *Biased expectation of the researcher:* This is the form of reactivity that the researcher influences the opinion of the participants, due to his/her biased view. We reduce this threat by involving people, who do not have expectations of the focus group/the contextual customer journey process.
- *Generalisation variables:* During the focus group, several elements are discussed: The contextual customer journey process as a whole and the guidelines used in the contextual customer journey process. In this way, we get an overall view of their

opinions about the process and the guidelines used in the process. The main threat here is that the thoughts and opinions around these two elements are generalised by the stakeholders and that they will influence each other. To reduce the threat, we make a clear distinction between when we discuss the whole process and when we use discuss the guidelines.

4.5.3. Internal validity

Because this is a technical action research, we are concerned about the effects of conducting the experiment on the results of the experiment. We have in mind the Pygmalion effect (the self-realising expectations of the research) and the Hawthorne effect (stakeholders tend to please or disappoint the expectations of the researchers). To reduce these risks, the following measures are taken into account:

- *Group threat:* The participants are randomly allocated and have an unbiased view around the focus group. The participants also have different backgrounds, which means that they can give different inputs around the contextual customer journey process.
- *Time threat:* with time, events may occur which lead to changes in the behaviour of the participants. The focus group is held in a short period of time, to reduce the risk of behaviour change.
- *History*: Due to the period when the focus group is held, the participants of the focus group are reached with the freedom of participation. In this way, the participants do not feel forced to participate. The experiment is also conducted within ContextBank, to realise the relaxed and chill environment.
- *Reactivity and experimenter effect:* There is a risk that a person may affect their behaviour and that they are going to respond to the demand characteristics of an experiment. In this way, they try to please (or annoy) the researcher. Therefore, we decided to not communicate the variables which are measured in the focus group.
- *Instrument change:* There is a risk that too much instruments are used in the focus group, which can lead to that the focus group takes in too much time, or that the participants find the change of instruments annoying. To reduce this risk, we have reduced the instruments to three: The post-its, MEM questionnaire and the GOMS model.

4.5.4. External validity

The external validity is about the fact that the results of the research can be used in different contexts and that it can be generalised: different places, different people and at another time. By using a real case of ContextBank and stakeholders which are concerned with the topics of the contextual customer journey process, a representative sample is used. We also interview the participants of the focus group one, to reduce the risk of different interpretations and opinions between sessions by the participants about the process.

4.5.5. Legal, ethical and professional issues

During this research project, we have taken the following steps to address the ethical issues:

- *Voluntary basis participation:* The focus group is organised on a voluntary basis, to not breach the participant's right to freedom and privacy to participate in the research experiment.
- *Non-disclosure agreement*: The researchers have signed an agreement, whereby they guaranteed that non-disclose information and/or data will be kept confidential and that it is only used for academic purposes
- *Data checked by ContextBank*: The data gathered from the focus group are checked by ContextBank, and pre-processed to keep the privacy of the organisation.

4.6. Results

To answer the research questions of the validation, we established for each research question 3 hypotheses or topics to discuss around (see Table 7). For RQ1 and RQ2, we established hypotheses to categorise if the stakeholders agree, disagree or have suggestions for improvements with the research question when the contextual customer journey process is applied. For RQ3 and RQ4, we established categories, due to the fact that these research questions have an exploratory intention.

Table 7 Categories for discussion research questions

RQ1 What is the perceived usefulness of applying the contextual customer journey process?	**RQ2 What is the perceived ease of use of applying the contextual customer journey process?**	**RQ3 What are the interpretations about the results of the contextual customer journey process artefacts?**	**RQ4 What kind of practical applications within ContextBank would the stakeholders envision for the contextual customer journey process?**
The contextual customer journey process is easy to use	The contextual customer journey process is free of effort	Architecture guidelines	Application of the contextual customer journey process
The contextual customer journey process is difficult to use	The contextual customer journey process is not free of effort	Contextual need guidelines	Application of guidelines of the contextual customer journey process
Suggestions for improvement of the usefulness for the contextual customer journey process	Suggestions for improvement of the ease of use for the contextual customer journey process	Colour traceability guidelines	Application of the results of the contextual customer journey process

Most of the information which is gathered from the focus group session is qualitative information. To analyse the qualitative data, we have decided to make use of NVIVO[5]. We use NVIVO for the analysis of the recording of the focus group.
To identify and structure meaningful information from the focus group, we propose a set of nodes. These nodes are grouped based on the defined research questions. The taxonomy which is used for the nodes is given in Figure 37. Figure 38 shows a screenshot of the explicit tagging of the recording in NVIVO.

[5] http://www.qsrinternational.com/nvivo/nvivo-products

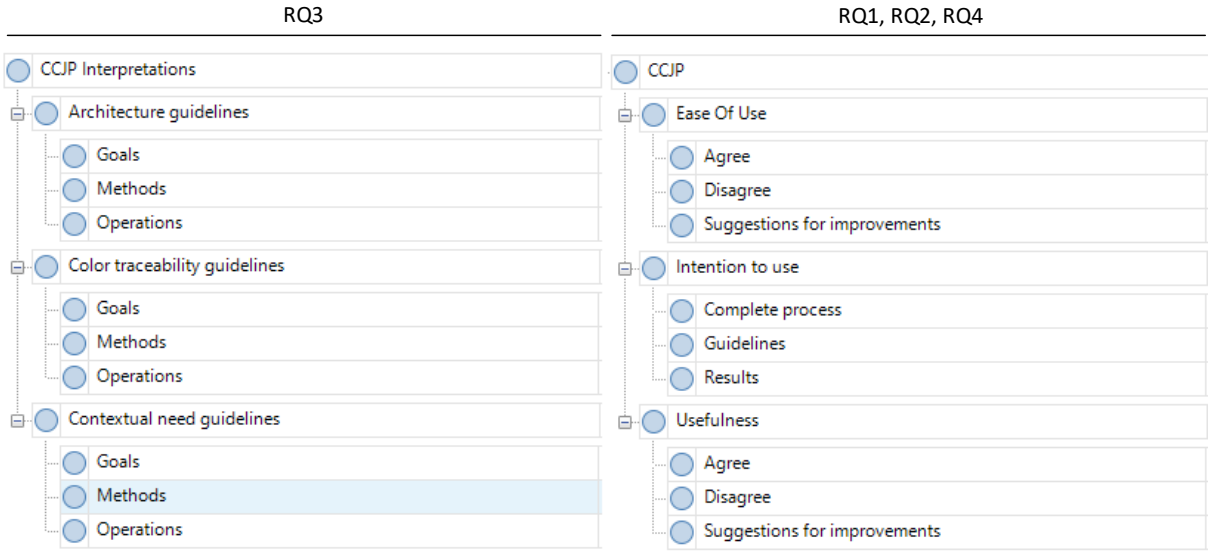

Figure 37 Node tree taxonomy NVIVO

Figure 38 Explicit tagging of the recording in NVIVO

During the focus group session, we created a set of 32 post-its from 3 participants in 6 posters. The poster had three initial categories. These were predefined based on the research questions. Table 8 depicts for each poster how the post-its were categorised and which audio fragments are linked to the category.

Table 8 Categorisation of post-its and audio fragments

Category	**Sub-category**	**Number of post-its**	**Number of audio fragments**
Realised artefacts			
Architecture guidelines	*Goals*	1	8
	Operations	2	12
	Methods	2	3
Contextual need guidelines	*Goals*	2	6
	Operations	3	8
	Methods	2	1
Colour traceability guidelines	*Goals*	2	5
	Operations	1	2
	Methods	1	1

Contextual customer journey process			
Ease of use	*Agree*	1	3
	Disagree	1	1
	Suggestions for improvements	1	4
Usefulness	*Agree*	4	3
	Disagree	3	1
	Suggestions for improvements	1	4
Intention to use	*Complete process*	2	4
	Guidelines	0	0
	Results	1	2

To analyse the results from the post-its and the recording, clustering was performed. Clustering is a tactic that can be applied at many levels to qualitative data. The goal of clustering is to understand and conceptualize objects that have similar characteristics or patterns by grouping them together (Miles & Huberman, 1994). Post-its and audio-fragments which express similar contributions were grouped. Since each post-it was expected to provide a single contribution, all of them fell in a single cluster. Table 13 till Table 11 summarise the resulting clusters for the following elements:

- Guidelines
    - Architecture guidelines
    - Contextual need guidelines
    - Colour traceability guidelines
- Contextual customer journey process
    - Ease of use
    - Usefulness
    - Intention to use

The tables indicate for each cluster its identifier (ID column), the number of post-its and/or audio fragments falling in the cluster (Num column), the source (source column) and its description. The cluster tables of the guidelines have a column to show if a comment is positive or negative (positive/negative column). The cluster tables of perceived usefulness, perceived ease of use and intention to use also have a MEM-questionnaire field, which describe the average scores from the questionnaire for each participant. Two out of three stakeholders of the focus group handed in the MEM-questionnaire: Business analyst 1 (BA1) and UX-designer 1 (UX1) (see appendix C for answers and graphs with the results).

Figure 39 Focus group Stakeholders writing down post-its while performing in the focus groups

4.7. Discussion

Based on the clustering of the focus group results, we can draw some key observations. Per cluster category, we will discuss the sub-categories. The categories are divided in two types: discussions around the understanding of the realised guidelines/artefacts (about the goals, operations and methods) and discussions of stakeholders' perceptions about the contextual customer journey process (perceived usefulness, perceived ease of use and intention to use). The structure of categories which we will discuss are:

- Guidelines
  - 4.7.1. Architecture guidelines
  - 4.7.2. Contextual need guidelines
  - 4.7.3. Colour traceability guidelines
- Contextual customer journey process
  - 4.7.4. Ease of use
  - 4.7.5. Usefulness
  - 4.7.6. Intention to use

4.7.1. Architecture guidelines

Table 9 Clustering Architecture guidelines

Architecture guidelines - Goals				
ID	**Num**	**Source**	**Positive /Negative**	**Description**
AG-G1	5	Post-its & audio	Negative	Improve the visualisation of the images
AG-G2	2	Audio	Positive	Link between CJ and Service blueprinting
AG-G3	2	Audio	Positive	Departments use elements of these guidelines already
Architecture guidelines - Operations				
AG-O1	2	Post-its & audio	Negative	Language
AG-02	5	Post-its & audio	Negative	Missing definition of terms
AG-03	5	Audio	Positive	Recognition of method & tooling
AG-04	2	Audio	Negative	Side-aspects around to the communication user-organisation are missing
Architecture guidelines - Methods				
AG-M1	3	Post-its & audio	Positive	Traceable process
AG-M2	2	Post-its & audio	Positive	Service blueprinting
AG-M3	1	Post-its	Negative	Depends per department if this method will be used

Goals

From Customer journey to Service blueprinting – A very positive aspect which was found in the goal of the guidelines by the stakeholders of the focus group was the link between customer journey and the service blueprinting elements (AG-G2). "During the UX-conference last month, we got a workshop around service blueprinting, and how to use this". The stakeholders (business analysts) compared the elements of the service blueprinting with the descriptions of the architecture guidelines and highlighted where they saw the extra alignment of customer journey to business services. They also stated that some departments are already using elements of the guidelines(AG-G3). For these departments, it should not be a problem to implement this way of working.

Improve visualisation of images in use case and description – The stakeholders found the images which were included in the description of the use case unreadable (AG-G1). The results of the use case should be described over a complete page, to make them readable. Another comment around the visualisations was to include images in the steps of the guideline. It would increase and simplify the understanding of the descriptions in the guidelines.

Operations

Language – One of the main drawbacks in the architecture guidelines was the language. "It is easier to read the text in the first language. Now it will take more time to go through it and understand it".

Methods & tooling – The methods & tooling were recognised in the descriptions of the architecture guidelines (AG-O3). The business analysts saw that the steps were based on the service blueprinting guidelines. Next to that, they saw that the visualisations were made with elements of ARIS[6]. This means that the theoretically described aspects are in line with how the organisation deals with their architecture descriptions

Definitions of terms – The main problem which the stakeholders saw was the definitions of terms. The departments make use of the methods & tooling, but it depends per department how they make use of it. This also lead sometimes to miscommunication between departments. By including a list of definitions of terms, this problem could be avoided.

Side-aspects – The last aspect which the UX-designer was missing in the descriptions of the steps in the architecture guidelines were the side-aspects of the customer journey (AG-O4). "Next to the main touchpoints between the organisation and the user, we also take side-aspects into account. Is the user searching on the internet? Is the user calling us in the process? Those aspects can have an influence on the experience in the journey".

Methods

Traceable process – The stakeholders found the sequence of steps very logical. "The steps are in line with service blueprinting. And these guidelines add the translation how to align this with customer journey touchpoints."

Department dependency – The main issue which they would see at ContextBank is that it depends per department if they could use these steps. "Every department works in a different way. They use different processes, different terms.". This could mean that departments will continue to work in the same way, due to misunderstanding of the architecture guidelines. "They should align to a uniform way to work with these architecture guidelines. Then it creates a structured way of working".

4.7.2. Contextual need guidelines

Table 10 Clustering Contextual need guidelines

Contextual need guidelines – Goals (*n=3*)				
ID	**Num**	**Source**	**Positive/ Negative**	**Description**
CNG-G1	2	Post-its & audio	Negative	Add description about context
CNG-G2	4	Post-its & audio	Positive	Logical goal
CNG-G3	5	Post-its & Audio	Negative	Mandatory rules are not taken into account
Contextual need guidelines – Operations (*n=3*)				
CNG-O1	3	Post-its & audio	Positive	Change "update persona" to "enrich persona"
CNG-O2	3	Post-its & audio	Positive	Customer insights from the bank are missing as input
CNG-03	3	Audio	Positive/ Negative	Tool to goal?
Contextual need guidelines – Methods (*n=3*)				
CNG-M1	1	Post-its	Positive	Logical sequence of steps
CNG-M2	1	Audio	Negative	What if the basic persona is enough?

Goals

Logical goal – The stakeholders understand the goal of the contextual need guidelines. The work which is fulfilled in the guidelines is linked to the responsibilities of the business analysts (for the realisation of requirements) and the UX-designer (communication with

6 https://www.softwareag.com/corporate/products/aris_alfabet/bpa/aris_architect/default

users/customers, realisation and updating of personas). Furthermore, the tool to goal discussion (which is stated in CNG-O3, will be discussed later) and the discussion around the basic personas (stated in CNG-M2) where part of the discussion if the goal is to always update the persona and where the limit is.

Context – The stakeholders were missing the definition of context in the contextual need guidelines. It was not clear for them what we meant with the term context. "Maybe you have to add a description of the context in the guidelines. In this way, the people who are making use of the guidelines will understand what context means and how it is related to a customer journey. We understood context after you explained what the context was, including examples like language. They will not get this.".

Mandatory regulation – One of the aspects which the stakeholders were missing in the story around the contextual need guidelines was the mandatory regulations where the bank has to deal with. This can lead to some necessary changes in the journey, which will lead to a lower user experience. "The mandatory regulations can lead to a lower experience. But if it is mandatory, the bank has to fulfil these rules". "We have to deal with compliance, legal and risk. This could be added to step 2 of adding requirements. A customer will not say that he wants to be checked for fraud. This are elements which are taken into account from the perspective of the bank".

Operations

Enrich persona – The stakeholders were struggling with the naming of guideline 3 – Update persona (CNG-O1). "When you are going to update a persona, this means that you are going to create a complete new version of a persona. This is not the case". One of the suggestions from the stakeholders was to call it "enrich persona". In this way, you can see that the persona is enriched, instead of that a complete new version of the persona is realised.

Customer insights as input – An aspect that the UX-designer was missing in guideline 1 – analyse the input was customer insights which are already gathered within the organisation. "When we create a squad, we have a boot camp in the first week, where we have interviews, reviews and check the restrictions from the banking business. This can be used as input later". The stakeholders stated that this was comparable to some input bullets in guideline 1, but that this is not input over time, but from data which is gathered at the beginning of the project.

From a tool to a goal? – The stakeholders found the contextual need guidelines a great addition for updating the personas and keeping the structure in the personas. "In this way, we would have a structured way to update the personas in combination with our way of working with the personas. This would definitely reduce the amount and types of personas within the organisation." The only aspect was the consideration to require the update of the persona. "Now we are using the personas as a tool to test our customer journeys. Would it be correct to make it a goal to update our tool constantly?" and "How far do we go with the update of the personas. When do we stop with including new aspects, which will create a large list of properties in the end?". We can observe based on this aspect the stakeholders prefer the way of working with four basic personas. But when you compare this to the literature review, it is stated that a main risk is that personas are not updated on the way together with the journey, and that it is difficult to improve them (use of empirical data or including irrelevant information) (Chapman & Milham, 2006). The main conclusion for this part was, after some discussion in the focus group, to describe explicit why this step is fulfilled and what will be done with the update of the persona.

Methods

Logical sequence of steps – The stakeholders of the focus group found the steps in de contextual need guidelines logical (CNG-M1). We can observe based on this post-it that they recognise elements from their way of working.

Basic persona – The stakeholders of the focus group were also considering about the sequence of steps which they have to take in the contextual need guidelines. They find the sequence logical, but what if the user of the guidelines thinks that the basic persona fulfils the needs to include a new contextual aspect already? (CNG-M2) Then they can decide to skip the update step, "keep it scoped to the four personas which are used to test" and only describe the requirements which are required for the solution.

4.7.3. Colour traceability guidelines

Table 11 Clustering Colour traceability guidelines

Colour traceability guidelines – Goals (*n=3*)				
ID	**Num**	**Source**	**Positive/ Negative**	**Description**
CTG-G1	2	Post-its & audio	Positive	Uniformity over departments
CTG-G2	3	Post-its & audio	Negative	Tooling dependent
CTG-G3	2	Audio	Positive	Creates an easy overview of changes
Colour traceability guidelines – Operations (*n=3*)				
CTG-O1	3	Post-its & audio	Negative	Uniformity in terms is required
Colour traceability guidelines – Methods (*n=3*)				
CTG-M1	2	Post-its & audio	Positive	Structured way of working

Goals

Uniformity over departments- The stakeholders wrote on a post-it in the goals section that the colour traceability guidelines create uniformity over the departments (CTG-G1). The stakeholders had the discussion around differentiation between departments and the way how they create architectures and show traceability. When the departments would make use of these guidelines (uniformity in traceability) in combination with the architecture guidelines (if AG-M3 is achieved) would create structure, which will also realise an easier way to communicate about architectures and the improvements.

Easy overview of changes- The stakeholders found the colour traceability a great way to show the overview of changes in the architecture which enables a customer journey (CTG-G3). "It is a very common way to show changes. If an element has a different colour compared to other elements, you know that something will change in the architecture".

Tooling dependence- One of the drawbacks the stakeholders had around the colour traceability guidelines was the tooling dependency (CTG-G2). "Our architects make use of ARIS. We are not sure if this is possible. If the tool does not support it, then it will not be possible to realise the step of the guideline". Based on this comment can we conclude that has to be checked for the tooling in the organisation which elements have to be adopted from the tooling to support the realisation of the colour traceability.

Operations

Uniformity in technique/terms – The stakeholders did not have any comments on the steps or that they were missing a step. The only drawback which they saw for these steps was again the uniformity in terms (similar compared to AG-O2 and AG-M3) (CTG-O1). There was a similar discussion around the terms which are used in the colour traceability guidelines ("it depends per department what their definition is of a business service"). "Departments should have a set of terms or have an agreement to create uniformity around terms, tools and techniques to work with. Then this can be a structured approach". Based on this comment we can conclude that an implementation strategy could be needed to create this uniformity.

Methods

Structured way of working- The stakeholders found the colour traceability guidelines a structured way to show the impact on the architecture when changes are made (CTG-M1). They also found the sequence structured in the process. "The steps which are taken in the

colour traceability guidelines are similar to the steps in the architecture guidelines. It must be possible to map the colour traceability on the elements of the architecture".

4.7.4. Perceived ease of use

Table 12 Clustering perceived ease of use

PEOU – Agree (*n=3*)			
ID	**Num**	**Source**	**Description**
A1	2	Post-its & audio	Easy and efficient way of working
A2	3	Audio	Improves communication within organisation
PEOU – Disagree (*n=3*)			
D1	1	Post-its	Everyone in the organisation has to make use of the same structure
D2	2	Audio	Not applicable in every situation
PEOU – Suggestions for improvements (*n=3*)			
I1	3	Post-its & audio	Add/Improve visualisations
I2	1	Audio	The organisation must feel the need to invest
MEM questionnaire – Mean of answers (*n=2*)			BA1: 2,66 UX1: 2
MEM questionnaire – Median of answers (*n=2*)			BA1: 3 UX1: 2,5

The contextual customer journey process is easy to use

Easy & efficient – The stakeholders wrote down on the post-it that the contextual customer journey process creates an easy efficient way of working (A1). The stakeholders think that it is a good way to describe a step-by-step process in guidelines. "If you get everyone in the organisation in the same direction, you have created a structured process within the organisation".

Improves communication- Another aspect which is taken into account is that the contextual customer journey process will improve the communication (A2). The main fact where the stakeholders are basing this on is the uniform structure which will be created within the organisation. The main requirement to realise this, is to convince everyone within the organisation to make use of this structure. In this way, the elements that are used over departments will be similar (same architecture, same traceability colours) which makes it easier to communicate.

The contextual customer journey process is not easy to use

Need to work in the same structure- One of the aspects where the stakeholders think of that the process will not be easy to use, is that everybody in the organisation has to work in the same structure (D1). Based on the discussions which were held for the guidelines about uniformity (CTG-G1 and AG-M3) and the use of terminology (AG-02, CNG-G1 and CTG-O1), we can conclude that the stakeholders do not think the process will work for now within the current situation of the departments within ContextBank. If there is uniformity over departments and a list of terms is included in the guidelines, the ease of use would be improved (easy & efficient way of working and communication improvement).

When to apply? - The main discussion which the stakeholders had around the post-its for disagreement was about when to apply the contextual customer journey process: Is it applicable for every context-addition and is it required to always go through each step?

Improvements to make the contextual customer journey process easier to use

Visualisations- The main improvement to improve the ease of use of the contextual customer journey process was given already during the architecture guidelines discussion: add/improve visualisations. In this way, the user will have a clear overview of the steps ("A

figure says more than a thousand words") and if the correct ratio visualisations/text is found. "users see the visualisation with the text. Then they know what they have to do, instead of going through pages with only textual descriptions.
Invest in the process – The stakeholders think there is a need to invest in the process within organisations before it can be used. Every department within the organisation has to work in the same way (uniformity) to create structure and improve communication. By writing an implementation plan, the organisation can work to a uniform way of working, where the employees are learning how to work structured.

MEM-questionnaire
The mean of the answers about the MEM-questionnaire about the perceived ease of use are 2.66 (BA1) and 2(UX1). When the MEM-questionnaire is aligned with the post-its & the audio fragments, we can state that the stakeholders of the focus group find it an easy way of working and that it will improve the communication, but that it does not work in the situation of ContextBank. Departments work in different ways and make use of different types of terminologies. If these points should be improved or included, it could mean that the stakeholders would find the contextual customer journey process easier to use.

4.7.5. Perceived usefulness

Table 13 Clustering Perceived usefulness

PU – Agree (*n=3*)					
ID	**Description**	**ID**	**Num**	**Source**	**Description**
A1	Structure	A1.1	2	Audio	Structured way of working
		A1.2	1	Post-its	Generic structure over departments
		A1.3	1	Post-its	Creates insights within the organisation
		A1.4	2	Audio	Can add value when there is a uniform way of working within the organisation.
PU – Disagree (*n=3*)					
D1	1			Post-its & audio	Process is not directly plug & play
D2	3			Post-its & audio	Requires training to work with the process
D3	2			Post-it & audio	Process should be findable within the organisation
PU – Suggestions for improvements (*n=3*)					
I1	1			Post-its	Looks like current decomposition methods
I2	Improve description	I2.1	3	Post-its & Audio	Create a repository of terms
		I2.2	1	Audio	Add visualisations
MEM questionnaire – Mean of answers (*n=2*)					BA1: 2,25 UX1: 3,63
MEM questionnaire – Median of answers (*n=2*)					BA1: 2 UX1: 4

The contextual customer journey process is useful
Structure – Based on cluster A1 (A1.1 till A1.3) we can observe that the stakeholders in the focus group found the contextual customer journey process a process which creates a structured way of working. The stakeholders saw that the models which are used in the guidelines are also used in the department for the realisation of architecture models. When one guideline is given to the departments within the bank where they have to work with, it will create a generic structure over the bank. In this way, "there will be a uniform way of communication. The departments will have generic guidelines where they have to deal with. In this way, every department will have the same structure, instead of that each department fills it in by themselves" (A1.4). An example which was given for this was the colour traceability: One department will assign changes in the architecture, while other departments will assign it with a different colour. Terminologies of architecture components are also

different per department: A business service is not the same for each department for example. These aspects can lead to miscommunication between departments.

The contextual customer journey process is not useful

Implementation plan required - The contextual customer journey process would not be easy to use within the ContextBank in the beginning: "Each department makes use of different terms, which makes it difficult to plug and play the contextual customer journey process (D1). It requires a training or a workshop to show the employees how they have to work with the process. (D2)" The stakeholders of the focus group state that you cannot use these descriptions directly after reading the guidelines. You have to understand the goal and each step.

Findability within the organisation – One risk which is also seen by the stakeholders, and which is linked to the need of implementation, would be the findability of the process within the organisation(D2). "Who has the document, where do they stay? Et cetera". If the employees cannot find the descriptions, they will work in the same way as they did before.

Improvements to make the contextual customer journey process more usefulness

Improve descriptions – The stakeholders gave two points to improve the descriptions of the guidelines: Create a repository of terms(I2.1) and add visualisations (I2.2). By creating a repository of terms "Everybody knows where you are talking about when using a term". The main point which the stakeholders stated about the visualisations was the amount of text. They stated that "an image says more than a thousand words. "When you create the optimal ratio between text and visualisations, you will have a win-win situation".

MEM-questionnaire

When you link the results of the focus groups against the results of the questionnaire, several aspects can be linked to the average results. The stakeholders found the contextual customer journey process quite useful (for example to realise a structure), but some elements are missing: The realisation of an implementation plan is required, the document must be findable and there must be uniformity over the departments within the organisation. When these aspects are solved, the descriptions are improved with visualisations and a repository is included, it could result in a higher experience for the usefulness.

4.7.6. Intention to use

Table 14 Clustering Intention to use

ITU – Complete process (*n=3*)			
ID	**Num**	**Source**	**Description**
C1	2	Post-its & audio	IST-SOLL analysis
C2	2	Post-its & audio	Depends on the customer journey if the process can be used
C3	2	Audio	Large complex customer journey projects
C4	1	Audio	Not usable for architecture improvement
ITU – Guidelines (*n=3*)			
ITU – Results (*n=3*)			
R1	2	Post-its & audio	Buying patterns of customers
R2	2	Post-its & audio	Recommendation engines
R3	1	Post-its	Traceability of impact in the architecture
MEM questionnaire – Mean of answers (*n=2*)			BA1: 2 UX1: 3
MEM questionnaire – Median of answers (*n=2*)			BA1: 2 UX1: 3

The complete process

The stakeholders would (not) use the complete contextual customer journey process for the following situations:

- *IST-SOLL analysis* – The stakeholders link the complete contextual customer journey process to the IST-SOLL analysis. From step 1 till 5 you describe the documented architecture of the customer journey. Step-by-step you are going to extend it with elements of the event logs and the contextual aspects how these are having an impact on the underlying architecture.
- *Large projects* - "When you have large projects, it can get more complex. Then it would be ideal to have guidelines, which can give structure in the process"
- *Not usable for architecture improvements* - "The process is mainly for projects which are customer journey based. If we only have to make changes in the architecture, we are not going to create everything around a customer journey.". "It also depends on the changes which are stated by the process mining framework or the new contextual aspect if the process can be used to improve the architecture".

Guidelines

No concrete examples were given by the stakeholders to use the guidelines for next to the main goals

Results

The stakeholders discussed about where they should use the results of the architecture for, and what kind of results they could realise with the contextual customer journey process. The stakeholders came with the following examples:

- *Buying patterns*-Patterns of products which a customer has bought. Based on this, a customer can get recommendations of products or categories a customer has to check
- *Recommendation engine*- Next to buying patterns, the contextual customer journey process could also add a recommendation of what other customers (which have a similar buying pattern) bought on the website.
- *Traceability of impact*- The last post-it the stakeholders of the focus group was about the traceability of impact in the architecture. The colour traceability gives a good overview of the changes, due to the different colours. In this way, you can see directly which elements will change.

MEM-questionnaire

The stakeholders gave in the MEM-questionnaire an average measure of 2 (BA1) and 3(UX1). Based on the answers which are given for the usefulness and the ease of use, and the examples for the intention to use, is that they see potentials to use it in practice. Based on drawbacks from the Ease of use (everybody needs to make use of the same structure and not applicable in every situation) and the usefulness (not plug & play, requires training and findability), it is obvious that the stakeholders do not see the intention to use the contextual customer journey process within ContextBank at the moment. Uniformity is a requirement for smooth integration over departments to create a structured way of working. This uniformity is not the case yet at ContextBank.

One of the comments which the stakeholders gave was that they can indicate if the contextual customer journey is really working (and that they get the intention to use) after they applied it in practice.

4.8. Summary

For the treatment validation, we conducted a focus group. The researcher applied the contextual customer journey process to include multilingual aspects in a customer journey (become an online customer) at ContextBank. To validate the contextual customer journey process and the results, we presented the process and the results in a focus group. The stakeholders in the focus group were two business analysts and an UX-designer. The goal of the focus group was to identify the stakeholders' perceptions and interpretations (Intention to use, Perceived ease of use and Perceived usefulness) of the contextual customer journey process. For the guidelines of the process, we checked the goals, operations and methods with the stakeholders for understanding and feedback for improvements. The contextual customer journey process was perceived as useful and easy to use: It was seen as a structured way of working, which creates structure over departments and insights within the organisation. Due to the structure in the guidelines, the stakeholders found the process easy and efficient and it should improve the communication within the organisation (uniform structure). The main drawbacks for the contextual customer journey process were that everyone has to make use of the same structure (tools, techniques et cetera) within the organisation and that the process is not directly plug and play: The employees need training to learn to work with the process. Concluding, the contextual customer journey was received positively. There were some remarks about how the contextual customer journey process could not work, due to the lack of adaptation to fit within the organisation. This could be solved by realising an implementation plan to implement the contextual customer journey process over the departments within the organization. The stakeholders mentioned: "there will be a uniform way of communication. The departments will have generic guidelines where they have to deal with. In this way, every department will have the same structure, instead of that each department fills it in by themselves". During the validation of this study, we considered the five types of validity threats: (1) conclusion validity, (2) construct validity, (3) internal validity, (4) external validity and (5) legal, ethical and professional issues.

5. Conclusion

Several ways are developed to improve a customer journey. This can be done by customer journey mapping and Process mining. Enterprises and organisations today face the challenge that they want to quickly adapt to different contextual aspects of customers in a customer journey. To realise this, a process needs to be realised which can add contextual aspects to a customer journey and how to align this to the underlying architecture which enables a customer journey.
To address the problem, we aimed to answer the following main research question:
"how to design a successful process for contextual customer journeys?"

The goal of this research was to develop a process to support the implementation of contextual aspects in customer journeys. In order to achieve this goal, we explored elements around the customer journey, the context and the enterprise architecture in the literature review. This literature review resulted in a set of main findings Next to the literature review, we also checked insights for the process from a practitioners' perspective. Based on the main findings, we created a set of requirements which the contextual customer journey should meet. In this way, we provide an answer on RQ1: "*What are existing methods to support a customer journey?"*

Based on the set of requirements, we started to define the contextual customer journey process. Based on interviews with practitioners and literature, we defined an 8-step process (the contextual customer journey process) to include contextual aspects with continuous refinement. For this process, three guidelines are realised:

- Architecture guidelines to map enterprise architecture elements from a customer journey to the application architecture
- Contextual need guidelines to define the contextual need based on input from users or the business. The guidelines result in a set of requirements and an updated persona
- Colour traceability guidelines to define and visualise the impact in the architecture.

To bridge the gap between the theoretical framework and real world practices, we applied the contextual customer journey process in the context of ContextBank. In this use case, we included the multilingual context in a structured way in the "become an online customer" journey.
Based on the design of the process, the realisation of the guidelines and the application of the contextual customer journey process in a use case, we answer the second research question: "*How to support contextual customer journeys?"*

To answer third and final research question ("*What are the stakeholders' perceptions when validating the process?"*), we held a focus group with three stakeholders to validate the contextual customer journey process. The focus group existed of an explanation of the process, discussions (including a post-it session) around the guidelines (the guidelines included a description of the steps in the guidelines and the application of the guidelines in the use case of ContextBank) and a discussion around elements of MEM (Moody, 2003) (Perceived Usefulness, Perceived ease of use and intention to use), including a survey with 16 questions about MEM (see appendix B).

Overall, we can conclude that the contextual customer journey process is a structured and logical approach to include contextual aspects into a customer journey. It also gives a quick overview of the changes which are required to include a new contextual aspect. It would be desirable to have a uniform way of working within the organisation and an agreement/repository about the terms to improve customer journeys with contextual aspects by making use of the contextual customer journey process. In this way, the communication between departments will be improved.

5.1. Limitations

During this research, there were some limitations. The first limitation is that the use case which is fulfilled to test the contextual customer journey process is limited to one customer journey. For this journey, we also tested only one contextual aspect. During this research, we haven't seen if the same results can be realised in a different journey or with a different contextual aspect.

The second limitation is that the contextual customer journey process is tested in only one organisation: ContextBank in the banking section. This makes it more difficult to generalise the results of the contextual customer journey process without further research. Some challenges of the research are identified by the literature, like adding a contextual aspect to a customer journey and how to translate the contextual customer journey to the underlying architecture. The elements which are used in the architecture reply to the customer journey of the use case, but it does not mean that the same structure can be used in different journeys (in different organisations). To reduce this limitation, we held a focus group with stakeholders from different departments from ContextBank. In this way, the stakeholders understand the models and methods which are use, so that they can be critic on the contextual customer journey process.

The last limitation of this research was that the stakeholders did not have to realise elements by making use of the guidelines of the contextual customer journey process. They could not test the complete guidelines and give their opinion about how it will work in practice. To reduce this limitation, the stakeholders checked the results which are realised while using the contextual customer journey process. In this way, they could check for example if they understood the outcome of the realised guidelines for the process.

5.2. Future work

Next to the conclusion, we identified some challenges in the contextual customer journey process which can be solved in future research:

- *Different sector* - This research only looked into one organisation in the banking sector. It would be interesting to see if the contextual customer journey process can be used in other organisations to generalise our results.
- *Different contextual aspects* - At this point, we only checked the multilingual aspect. What if we should take other contextual aspects into account, like customer preferences, hobbies, buying behaviour et cetera.
- *Contextual needs* - The research in the use case is (at the moment) based on the need of the business. It has to be checked if other types of input (like interviews and reviews) will lead to the same type of contextual need descriptions. For long-term perspective, it can be interesting if it is possible to define the contextual need in an automated way (by making use of for example process mining).
- *Multiple customer journeys* - At present the contextual customer journey process can be used for one customer journey at a time. What are possibilities when we check contextual aspects over multiple journeys? This will create challenges around how to deal with the different types of journeys, different architectures, different personas and how to deal with the different views within the organisation.
- *Requirements translation* - In requirement engineering perspective for the contextual customer journey process, it would be interesting to see how requirements which are realised from the contextual can be realised and translated to a solution in a more structured way.
- *The customer experience is not compared to the previous version of the customer journey* - It can be interesting to see if the experience of the user is lower or higher after the contextual aspect is included in the customer journey. The main question for the user experience is also the way how to measure the experience.
- *The architecture and traceability perspective* - For now, we only checked the mapping of the customer journey to the application components. It would be interesting to

see if it is possible to map these elements to the technology layer. It is also not researched if a different type of architecture (like software architecture) can be mapped in the same way. For the traceability can be checked if colour traceability is the most ideal way to map the impact. The stakeholders preferred this method to show the impact in an easy way. It can be interesting to see if different ways for traceability can improve this experience (for example with visualisation of the impact with different types of figures).

5.2.1. Practitioners perspective

Next to the theoretical perspective for future work, we also observed some future work from the practitioners' perspective. The practitioners have to deal with the following aspects:

- *How to deal with Multiple customer journeys* – It can be difficult when end points change based on the new contextual aspects. Organisation then have to define how they manage these changes over multiple journeys and what the impact in one customer journey can mean for the other. What happens for example when a business service needs to change in one customer journey to enable a contextual aspect, while the business service will not be useful for another customer journey anymore.
- *Regulations* - In what way can the architecture be changed with contextual aspects to realise a more personalised experience, while organisations have to deal with regulations within their business. A customer wants to have the more personalised experience, but that cannot imply that elements in the architecture that solves problems around the regulations (like legal, risk & compliance) can be changed. How to deal with the ratio customer experience/regulations?
- *Multiple personas*- How to manage multiple personas. Would it be ideal to update personas per department separate or would it be ideal to constantly update one set of personas (which will create uniformity over the departments)?
- *GDPR conform regulations* – How to inform users when organisations are making use of which information when you are constantly updating the journey with new contextual aspects of the user?
- *Change management plan to implement the contextual customer journey process within organisations*- To enable organisations to work with the contextual customer journey process, implementation plans (change management) have to be written to teach the employees how they have to work with the process. For the implementation plan, the following products can be realised to create uniformity & structure:
    - Courses
    - Presentations
    - Workshops
    - Protocol documents
    - Standards
    - Et cetera

To Improve the way of working for the employees with the contextual customer journey process, technological artefacts have to be developed. In this way the way of working with the contextual customer journey process will be improved and it will be easier to share/discuss the realised models of the process within the organisation. The following technological artefacts can support the contextual customer journey process:

- *Customer journey to enterprise architecture support* - At the moment, no tools directly support to directly link the customer journey to the business services in the enterprise architecture. If this is realised, it will reduce the workload in the architecture guidelines of the contextual customer journey process.
- *Multiple colour support* – Tools only support one colour traceability per element to show impact in the architecture. It would be ideal to extent this to two or more

colours. In this way, it will be possible to show multiple types of impact from event logs and one (or more) contextual aspect(s).

- *Traceability support* – An interesting technology artefact which would support the colour traceability guidelines is a traceability support tool. By making use of this tool, visualisations of impact based on the event logs and the contextual aspect(s) are given in the customer journey and the enterprise architecture. When using this tool as an employee, the tool will support:
    - *Requirement linking* – Requirements which are defined based on the contextual need have to be linked to the elements in the customer journey and the enterprise architecture. In this way, it will be possible to check which impact in the customer journey and the enterprise architecture are linked to a specified requirement. In this way, the traceability is improved.
    - *Impact description per element* – Per impacted element in the customer journey and the enterprise architecture should it be possible to give a description about the type of impact. It could also be possible to give an indication of the weight of the change (how much time will it take to include the change?)
    - *Filtering* – It should be possible to filter which impact (event logs, contextual aspect, requirement, et cetera) an employee wants to show in the customer journey and the enterprise architecture. In this way, it will be easier for the employees to discuss about these impacted elements.
    - *Hover option* – When someone hovers over an impacted element, the tool must show a description which includes the type of impact (event log or contextual aspect), the requirement and the changes which are required.

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Appendix A: Use case

ContextBank is a bank that belongs to the banking sector in the Netherlands. ContextBank operates a software eco-system of applications to support their information systems. This eco-system is used by multiple organisations and delivers all types of services for Sales/Buying processes, service processes, marketing, bannering et cetera. ContextBank uses this eco-system for communication with their customers. Typical bank customers are individuals and businesses. To let customers communicate with the bank, they make use of services of this eco-system. One of the main goals of the bank is to provide their customers the most complete and ideal customer journey. The journey should be attractive and relevant. The main goal for the bank is to deliver a smooth 9+ out of 10 customer journey. In beliefs of the bank, the 9+ out of 10 journey is the only way customers remains or becomes customer at a financial services provider. Products become commoditised, and margins drop on commodity products. The 9+ out of 10 customer journey can be achieved by tuning applications, data and services to each other. Based on an interview with a business architect at ContextBank, they indicated that for example not all pages on the website are completely translated: There is a separate page describing the main aspects of the bank in the English language. To improve their customer journey, ContextBank wants to facilitate communication with customers by means of multilingual support. By realising this aspect, the bank gets a multi-lingual system, which adapts language based on preferences of their customers. In this context, the eco-system should consider modern expectations from all types of users, young and elderly people, banked or unbanked, digital natives or not, thereby focusing on the most relevant customer journey for all interactions and processes with customers on all relevant channels.

The Dutch translations of text are checked at the ContextBank. When the ContextBank wants to implement support for different language, the department has to check these translations by themselves, which takes more time. The ContextBank has a need to implement multilingual support to improve the customer experience.
The main question for the bank is how an application architecture for the multi-lingual customer journey looks like. For this, it is vital to have a holistic approach where the architecture needs to be defined using standards, organisational processes, and customers' preferences. To solve this question, we plan to explore the customer journey mapping model by Bernard et al. and to apply process mining techniques to extend their proposal to support the realisation of a multilingual application architecture. To get an idea for the alignment including the multilingual context, the metamodel of the generic model is visualised into the context of the use case. The model for the use case is visualised in Figure 40.

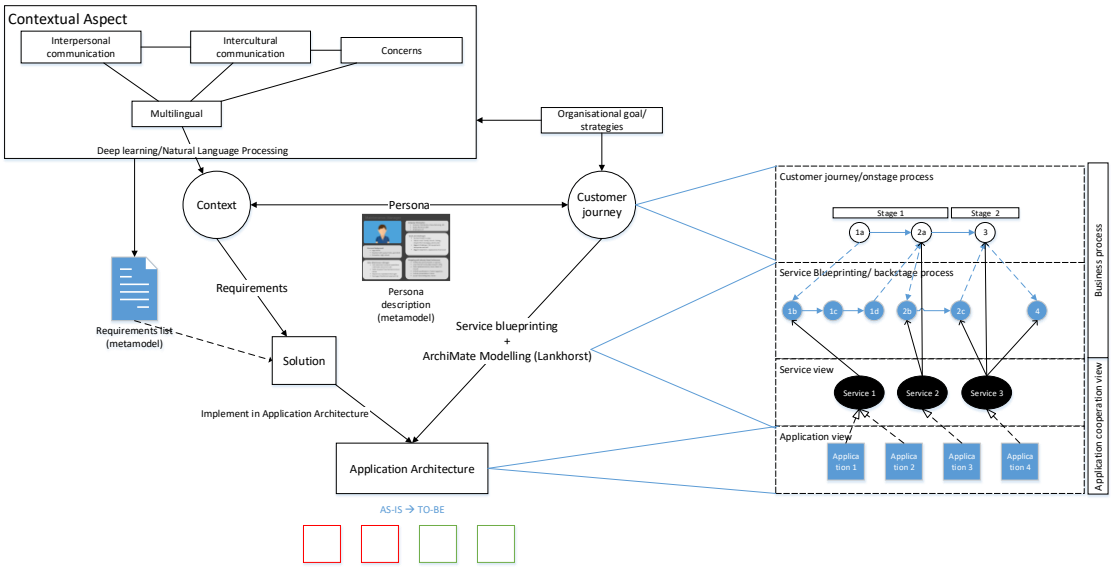

Figure 40 Application of the conceptual framework to the use case from the banking sector

Customer journey

The customer journey which is used to include multilingual aspects at ContextBank is the registration journey. When a customer fulfils the touchpoints of this stage, they have opened a payment/savings account and they receive a payment card. First, the customer will get an explanation around the types of accounts they can open (payment account and/or a savings account). After the account explanation, an explanation is given of the steps the customer has to fulfil to request an account. First, the customer has to fill in their personal information. Second, the customer has to take a picture of their ID for validation. Third, the customer has to sign an agreement, where the customer accepts the conditions to open a payment account at ContextBank. The last step the customer has to fulfil is that they have to fulfil an iDeal payment of 0,01 cent, to confirm their identity. After the four steps are fulfilled, the customer will receive a confirmation on the screen and the customer will receive an e-mail. After 2-3 days, the customer will receive a letter from ContextBank, including the payment card and the card details.

An overview of the touchpoints in the customer journey is given in Figure 41.

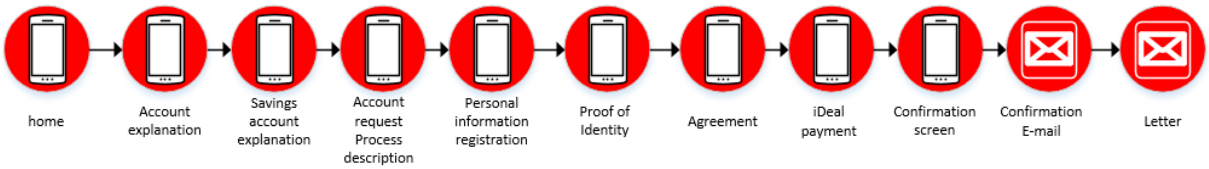

Figure 41 Customer journey: Registration

The main problem for the registration journey is that the Dutch translations in the mobile banking application of ContextBank are well described. When the user wants to switch to the English translation, the user will only see a partly translated Home screen (a combination of the Dutch and English translation) and it is not possible to fulfil the registration journey in English.

Findings event logs

Based on the event logs, which are registered by ContextBank, is found that there is a large outfall of users under the age of 18. The main rule for opening a payment account is that the user is at least 18 years old. When the user is not, he or she has to go to a local bank to open an account.

When a user wants to register, they are not directly informed about this fact. The user is noticed about this fact, after the user has filled in his personal details (including the date of birth) and clicks on next. Around 60% of the outfall in the registration journey in the application is due to underage.

Figure 42 Affected touchpoints event logs use case

To solve this problem in the application, the user has to be informed early about when a user wants to register for a payment account, the user has to be at least 18 years old (and that they have to go to a local bank to register for a payment account). After this step, it should also not be possible for the user under 18 to register (date picker with minimum age).

The affected touchpoints are the account explanation touchpoint (include explanation about at least 18 years old) and the Personal information registration touchpoint (minimum age date picker). These touchpoints get the blue traceability mark (see Figure 42).

Persona

To test the intended customer journey, ContextBank made use of the persona of Fadil. Fadil is a 25-year-old male student, who has a bank account at ITB Bank. At the moment, Fadil does not like his current bank, due to the fact they do not deliver everything in a uniform way. He wants to have a similar experience over multiple channels. The main problem which Fadil also had, was that he prefers to read everything in English instead of Dutch. The main reason for this, is that he masters the English language more than the Dutch language. A description of the persona, which is used by ContextBank, is given in Figure 43.

Figure 43 Persona ContextBank

Step 1: Describe intended architecture

In the first step, the intended architecture around the touchpoints of the registration customer journey are described. To describe the architecture, the business services, business process steps, the application services and the application components are described by making use of the architecture guidelines. Due to scoping to look from a user view, the elements of the application services and the application components are only described for the process steps fulfilled by the user.

From touchpoint to business service

1. The first step is that the registration customer journey is linked to the registration process. This process returns in the step when describing the business process.
2. The second step is to link the persona to the business role in the process. Fadil will fulfil the role as user in the process.
3. The third step is to link the touchpoints to business services in the architecture. To realise the touchpoints, seven business services are realised.
   Registration request service is used to enable the request for a payment account. The information service is used to give the user explanations around the types of accounts they can request. The registration service is used to register the details of a user. The identification service is used to validate the ID of the user. The agreement service is used to check that the user agrees with the conditions of the payment account. The payment service is used to fulfil the payment of 0,01 cent. The confirmation service gives the customer a confirmation of the request in the application and in the e-mail. Afterwards, the confirmation service will send a letter with the payment card and further details.

A visualisation of this step is shown in Figure 44.

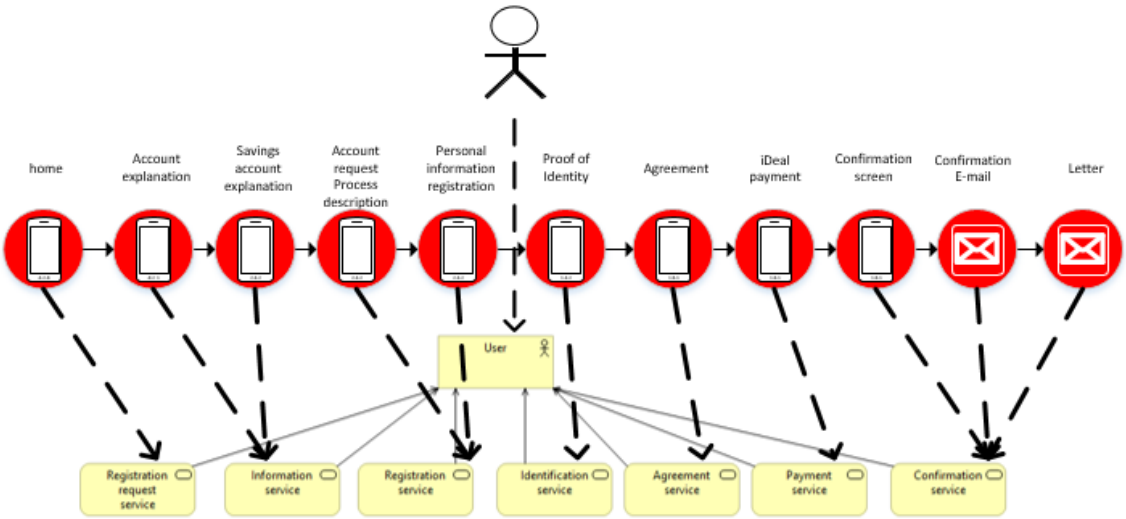

Figure 44 Touchpoint to business service use case

From business service to business process

After the business services are described, the business processes can be described.

1. First, the onstage actions of the user will be described. The user has to fulfil 13 steps to register and identify himself to request a payment account.
2. Second, the backstage actions by the organisations will be described. Due to scoping, the overall process step of the employee is called customer onboarding. In the customer onboarding process, the employee will validate the registered information by the user.
3. The last step is the description of the backstage actions. After the validation of the user/customer, the ContextBank will register the product (payment account) for the user and realise an agreement. The last step is that the payment card is sent to the user.

A visualisation of this step is shown in Figure 45.

From business process to application service

After the descriptions of the process steps, the application services which enable these steps can be described.

1. First are the application services described. To realise the complete registration process, the online platform service is required. This service realises that the mobile banking

application is running. To provide information about the different types of payment accounts, an information service is used. For the registration of the user details for the payment account, a registration service is used. For the selection of the type of Identification card and the camera function in the application to take pictures of the identification, an identification service is used. To let the user agree with the conditions around the payment account, an agreement service is used. To pay the 0,01 cent with iDeal to identify the user, a payment service is used. After the user has fulfilled the steps, the employees of ContextBank are making use of the user registration validation service to onboard the customer and register the products.

2. The application services are linked to the business process steps, like stated in the first step.

A visualisation of this step is shown in Figure 46.

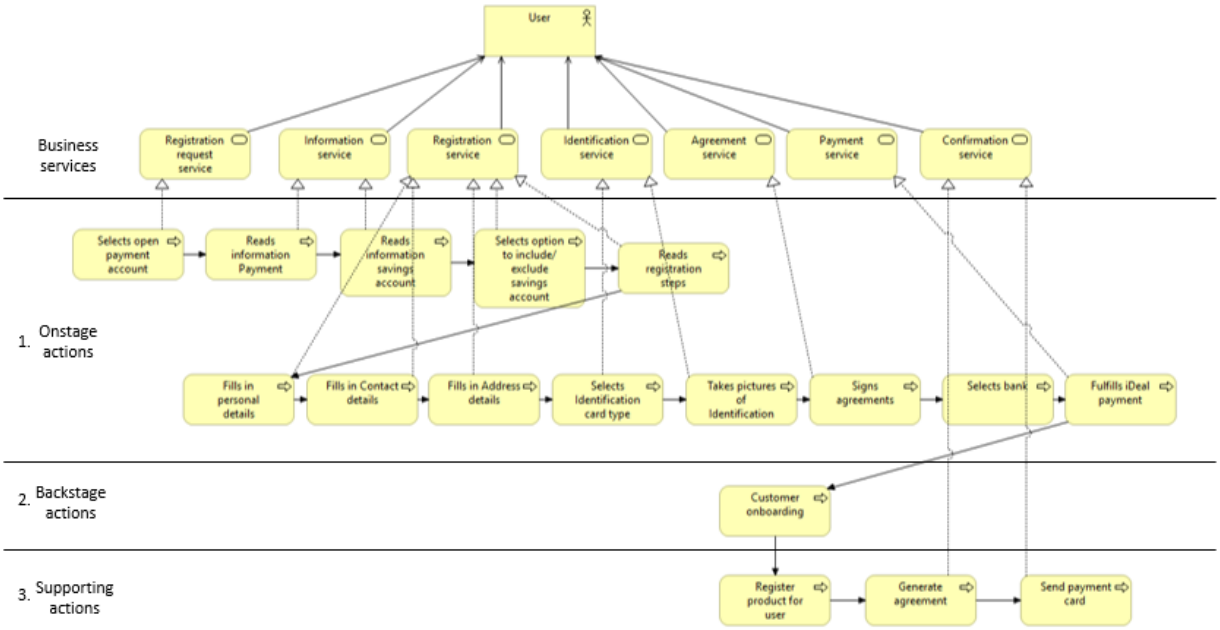

Figure 45 business service to business process use case

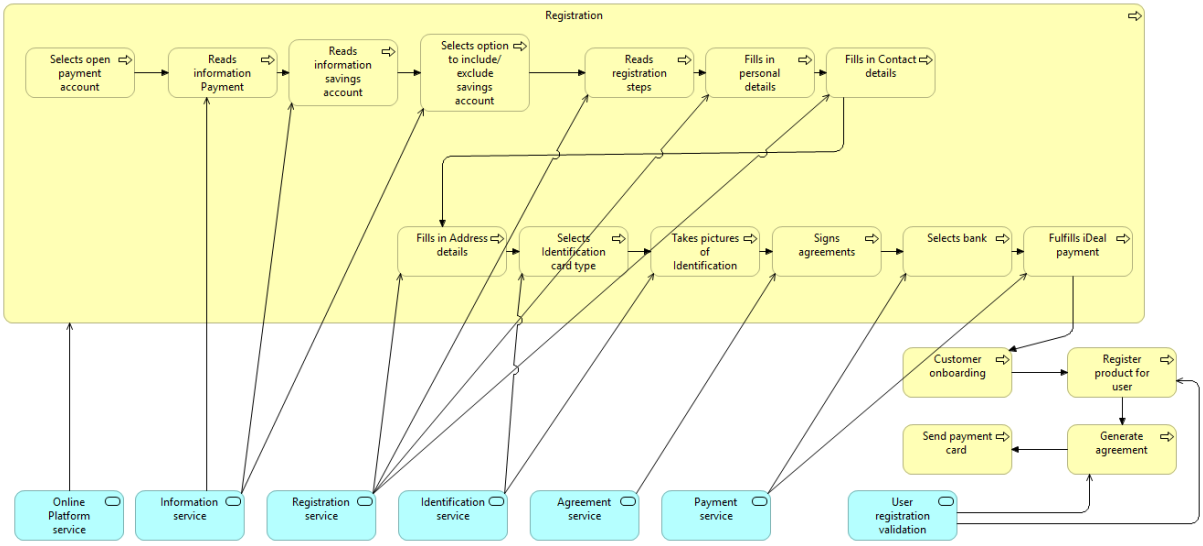

Figure 46 business process to application services use case

From application service to application components

The last step to describe the application architecture, is to link application components to application services

1. First, the application components are described which enable the application services. To realise the online platform service (to realise the registration process) and the information service, the ContextBank Online Platform application component is used.

This component consists of a front-end, back-end and a Content Management System. To track the registration and save the details through the process (registration, identification, agreement, payment and user registration validation) Track is used. To realise the Identification service, ContextBank has realised an Identification Photo Transcoder. For the payment service, ContextBank makes use of iDin. iDin is used to identify a user at organisation, by fulfilling a payment.

2. Link the application components to the application services with a realisation flow
3. There are no concrete collaborations between application components. In the ContextBank Online Platform, the frontend is communicating with the backend and the backend gets information from the Content Management System
4. Link the collaborations with the relationship flow

A visualisation of this step is shown in Figure 47.

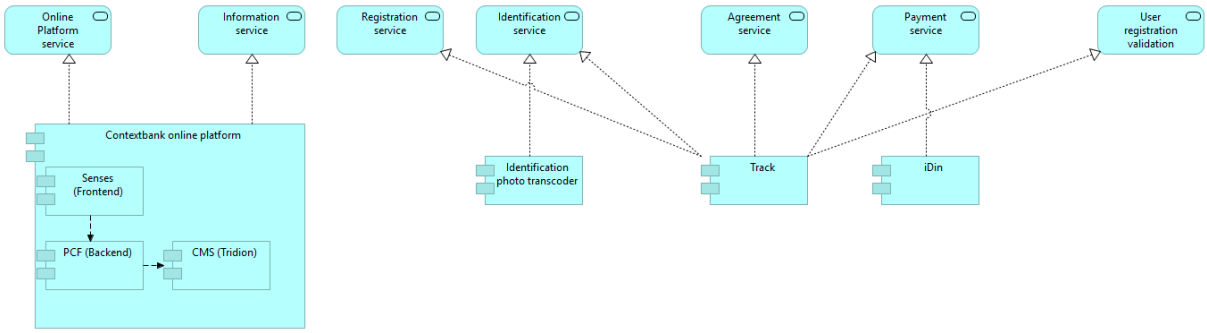

Figure 47 Application services to application components use case

Step 2: Describe the AS-IS situation

After describing the intended architecture, the changes for each level in the architecture can be described. In this step, the impact on each level will be described based on the changes due to the event logs. Based on the event logs, age restriction information is included in the account explanation touchpoint and a date picker (with minimum age) is included in the personal information registration touchpoint. To show the changes in the underlying layers of the architecture, the blue traceability mark is used.

1. **Describe the changes in the business service layer**

   In the first step, the changes in the business service layer will be described.

   a. **Describe affected business services**

      The information service and the registration service are affected by the change of age restrictions. In the information service, the user will see next to the descriptions around the payment accounts, that they have to be at least 18 years old to open an account via the mobile banking application of ContextBank. Otherwise, the user has to go to a local bank to open a bank account. The registration service will also be changed for the user. The user does not have the possibility anymore to select a date under 18 years old. In this way is prevented that users stop halfway in the registration process, due to age restrictions.

   b. **Describe new business services for existing touchpoints**

      To realise the age restriction, no new business services are required for the existing touchpoints

   c. **Describe new business services and link existing business services for new touchpoints**

      No new touchpoints are realised.

   d. **Traceability**

      Give the blue traceability mark to the registration service and the information service business services

A visualisation of this step is given in Figure 48.

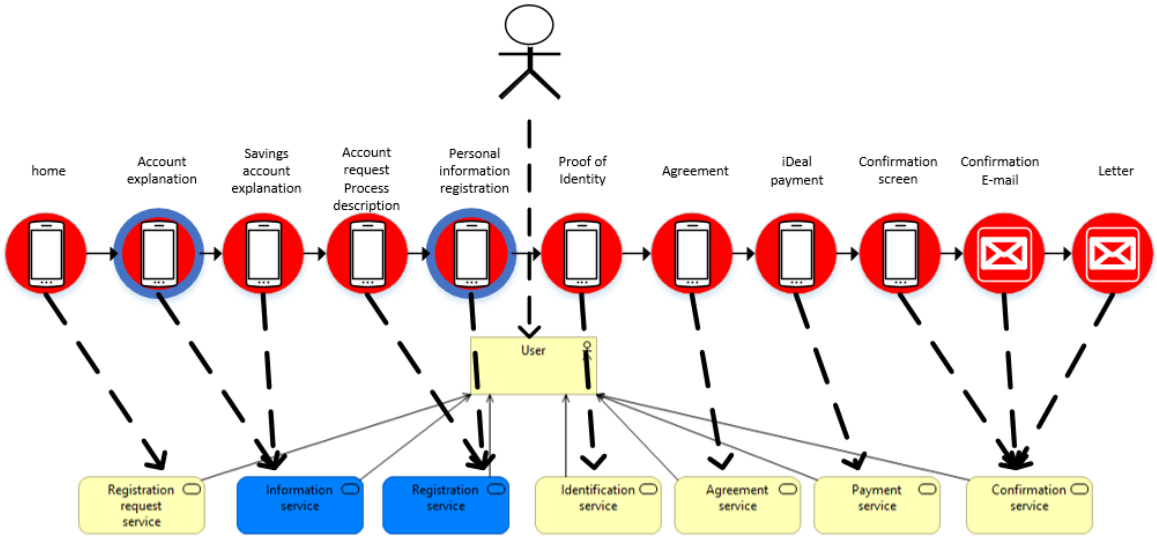

Figure 48 changes business service layer AS-IS use case

2. Describe the changes in the business process layer

The second step is to describe the changes in the business process layer

a. **Describe adjustments in the business process**

i. **Onstage actions**

No adjustments are need in the onstage actions in the registration process. The user will be informed earlier about the age restriction and it is not possible for the user to fill in a date of birth under 18 years old, **but** the process steps are not changing due to these facts.

ii. **Backstage actions**

The activities for the employees in the registration process are also not changing. The employees still have to check the details of the user in the onboarding process.

iii. **Supporting actions**

There are no adjustments in the supporting business process steps. The supporting steps are not dealing with the elements around the age restrictions.

b. **Describe the new business process steps**

No new business process steps are required to fulfil the age restriction changes in the registration customer journey

c. **Traceability**

Due to the fact that no new process steps are realised or existing process steps are adjusted, the blue traceability mark in the business process layer are not needed.

A visualisation of this step is given in Figure 49.

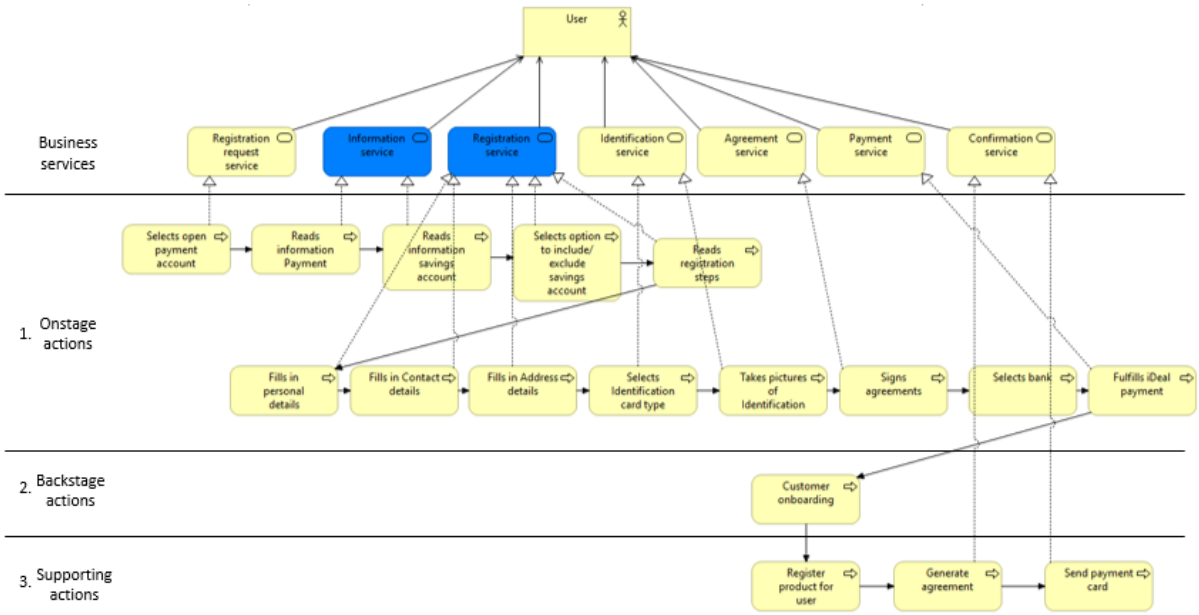

Figure 49 changes business process layer AS-IS use case

3. Describe the changes in the application services layer

The third step is to describe the changes in the application services layer

a. **Describe adjustments in the existing application services**
   Three existing application services are adjusted to realise the adjustments around the event logs. The Online Platform Service is affected, due to the fact that a date picker has to be included in the front-end part of the registration form. The information service is affected, due to changes in the description around the payment accounts (that the user has to be at least 18 years old). The last service which is changed is the registration service. The registration service will only be applicable for users which are at least 18 years old. The date picker has a minimum age, so people under 18 do not need the message anymore in the registration that they have to go to a local bank (already described in the information around payment accounts).

b. **Describe new application services**
   To realise the age restriction in the registration customer journey, no new application services are needed

c. **Link to business process**
   Due to the fact no new application services are realised, no new links have to be set to the business process steps.

d. **Traceability**
   Give the blue traceability mark to the Online Platform service, the Registration service and the Information service.

A visualisation of this step is given in Figure 50.

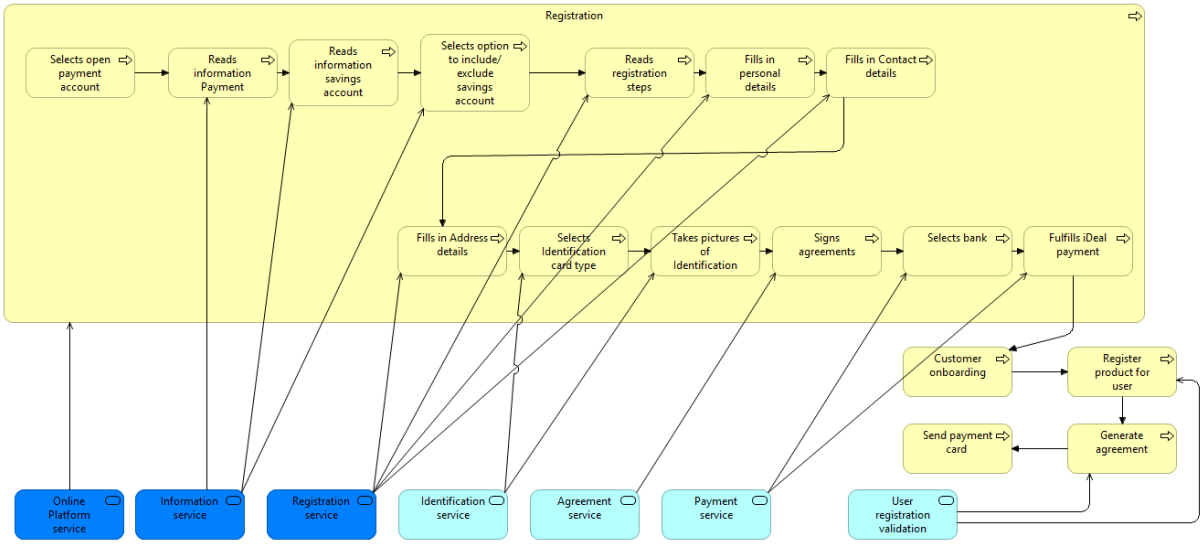

Figure 50 Application services layer AS-IS use case

4. **Describe the changes in the application components**
   The last step to describe the AS-IS situation is to describe the application components layer.
   a. **Describe adjustment in the existing application components**
      In the existing application components, two components are adjusted: The frontend (in the ContextBank Online Platform component) and Track. The frontend gets a date picker for the registration of a user. Track does not have to check anymore if a user is 18 years old.

      The information service (application service) is affected by the changes, but this does not change the functionality of the underlying components.
   b. **Describe new application components**
      No new application components are required
   c. **Link application components**
      Due to the fact that no new application components are realised, no new links have to be set.
   d. **Traceability**
      Give the blue traceability mark to the following application components: Frontend and Track.

   A visualisation of this step is given in Figure 51.

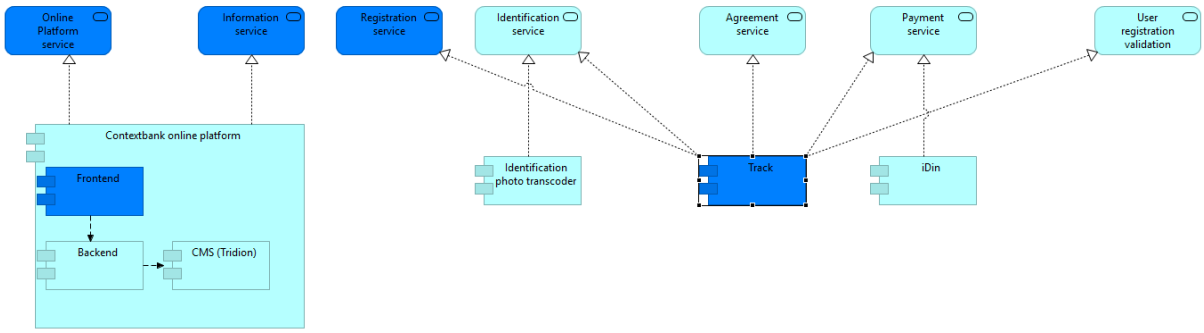

Figure 51 changes application components layer AS-IS use case

Step 3: Define the contextual need

After the AS-IS situation is described, the contextual need can be added to the customer journey. To see which contextual aspect has to be included, it has to be defined.

1. **Analyse the input**

Based on the business input of ContextBank, the following aspects are found:

- Users of the mobile banking application do not have the option to select the preferred language in the application.

- Users of the mobile banking application do not have the multilingual support through the whole application. The application is completely in Dutch. Only the main elements are translated in English.
    - Users cannot register for a payment account in their preferred language

In this way, the facilitation of communication with the users of the application is low. This leads to that people who do not fluently speak Dutch are going to a different bank.

2. Define contextual problem/need

The contextual need ContextBank has is add multilingual support. This can be achieved by taking interpersonal, intercultural and concerns around the multilingual context into account. In this use case, the main focus of the multilingual aspect is on the English language. By improving the facilitation of language support, the customer experience will be improved.

3. Define requirements

Based on the contextual need defined in step 2, and the analysis in step 1, define the requirements which are linked to the contextual need for the registration customer journey. These requirements are based on the contextual need and the defined requirements of ContextBank around multilingualism.

1. Define contextual requirements: To include the new contextual aspect (multilingual support), the following requirements are realised:

- *R1:* A user wants to use the mobile banking application in their preferred language
- *R2:* A user want to register for a payment account in their preferred language
- *R3:* A user wants to have the possibility to select their preferred language for the registration process
- *R4:* A user wants to receive content in their preferred language for the registration process
- *R5:* A user wants to receive error messages in the process in their preferred language

2. Categorise requirements: After the definition of the requirements, the requirements have to be categorised between the three categories. R1 is for the stakeholder group category, due to the fact that it is defined for all the users of the application. R2, R3, R4 and R5 are specific user characteristics, due to the specification of users who want to open a payment account.
3. Describe possible solutions: After categorisation, possible solutions can be described for the requirements. These can be as followed:

- *R1:* Option for a language preference or language identification by making use of parameters. The content (text) should also be translated to the preferred language.
- *R2, R3, R4, R5:* Translation of content (text), based on the preferred language parameters. There should be language uniformity through the process of the registration for a payment account.

Category	**Functional requirement**	**Temporal change**
Stakeholder group: users of the ContextBank mobile banking application	*R1:* A user wants to use the mobile banking application in their preferred language	Language preference option, language translation, parameter identification
User Characteristics: English users who want to open a payment account	*R2:* A user want to register for a payment account in their preferred language *R3:* A user wants to have the possibility to select	Language translation, multilingual text support, multilingual error messages

	their preferred language for the registration process *R4:* A user wants to receive content in their preferred language for the registration process *R5:* A user wants to receive error messages in the process in their preferred language	
Personal goal(s)		

Step 4: Describe Context-based persona

Based on the need to add a multilingual context, the persona has to be updated. The gender, profession, bank products, age and family are already taken into account. But the language aspect was missing in the description of the persona. By including the language aspect, it is possible to check the language of the user and in which language the application has to be set. The updated persona of Fadil is shown in Figure 52.

Figure 52 Context-based persona use case

Step 5: Describe the TO-BE situation

The last step is to describe the TO-BE situation (including the impact) by making use of the architecture traceability guidelines. The steps describe how the new elements (language select, multilingual text support, multilingual error messages) are implemented and what the impact is in each layer.

1. **Describe the changes in the customer journey (touchpoints)**
   The first step is to describe the changes in the touchpoints
   a. **Describe affected touchpoints**
      All the touchpoints are affected by adding the multilingual context. The customer gets a translation in his preferred language (English or Dutch), instead of that the registration process is only possible in Dutch
   b. **Describe new touchpoints**
      No new touchpoints are required, to include the new contextual aspect.
   c. **Traceability**
      Give the green traceability mark to the affected touchpoints.

   A visualisation of this step is given in Figure 53.

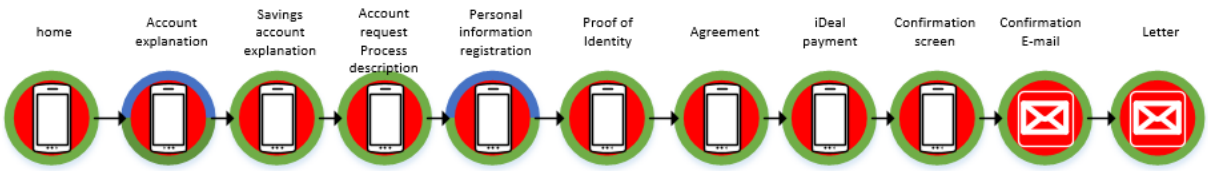

Figure 53 customer journey layer TO-BE use case

2. **Describe the changes in the business service layer**
   The next step is to describe the changes in the business service layer
   a. **Describe affected business services**
      No adjustments take place in the existing business services. The functionality of the services stays the same for the user of the application
   b. **Describe new business services for existing touchpoints**
      No new business services are required for the existing touchpoints, due to it only affects the language the user reads in the application
   c. **Describe new business services and link existing business services for new touchpoints**
      No new touchpoints are realised, which means that no new business services are required and no new business services have to be realised.
   d. **Traceability**
      No green traceability mark is needed.

   A visualisation of this step is given in Figure 54.

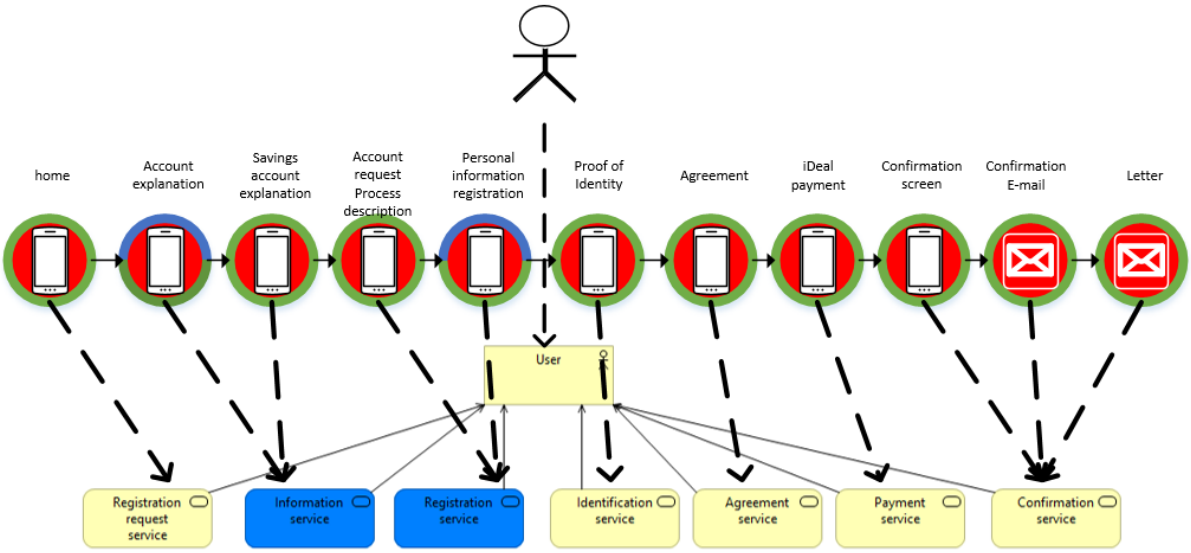

Figure 54 Business service layer TO-BE use case

3. **Describe the changes in the business process layer**
   The third step is to describe the changes in the business layer
   a. **Describe adjustments in the business process**
      i. **Onstage actions**
         No changes are required in the onstage business process steps to include the multilingual support.
         Backstage actions
         The backstage actions are not influenced by the multilingual support. The employees see the content in the Dutch language.
      ii. **Supporting actions**
         The supporting actions are not influenced by the multilingual support.
   b. **Describe the new business process steps**
      No new business steps are required to include the multilingual support. It would have been a possibility to include a step to select a language on a screen. But now, the user can select the preferred language (English or Dutch) in the home screen.
   c. **Traceability**
      Due to the fact no new business process steps are included, the traceability is not needed.

A visualisation of this step is given in Figure 55.

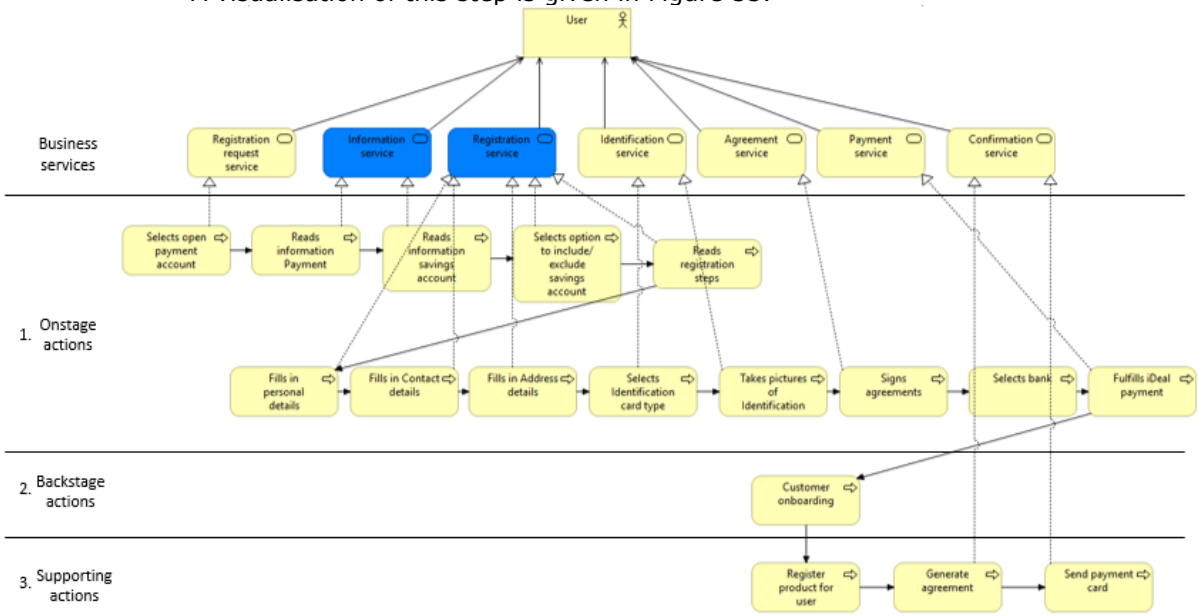

Figure 55 Business process layer TO-BE use case

4. Describe the changes in the application services layer

The fourth step is to describe the changes in the application services layer.

a. **Describe adjustments in the existing application services**
   In the existing layer, the Online Platform service is adjusted. The service is extended with multilingual support (English language) and an option to select a language is included in the application. The information service is also adjusted, due to translation of the descriptions.

b. **Describe new application services**
   No new application services are required to include multilingual support in the application.

c. **Link to business process**
   No new application services are realised to link to business process steps.

d. **Traceability**
   Assign the green traceability mark to the Online Platform Service and the Information Service.

A visualisation of this step is given in Figure 56.

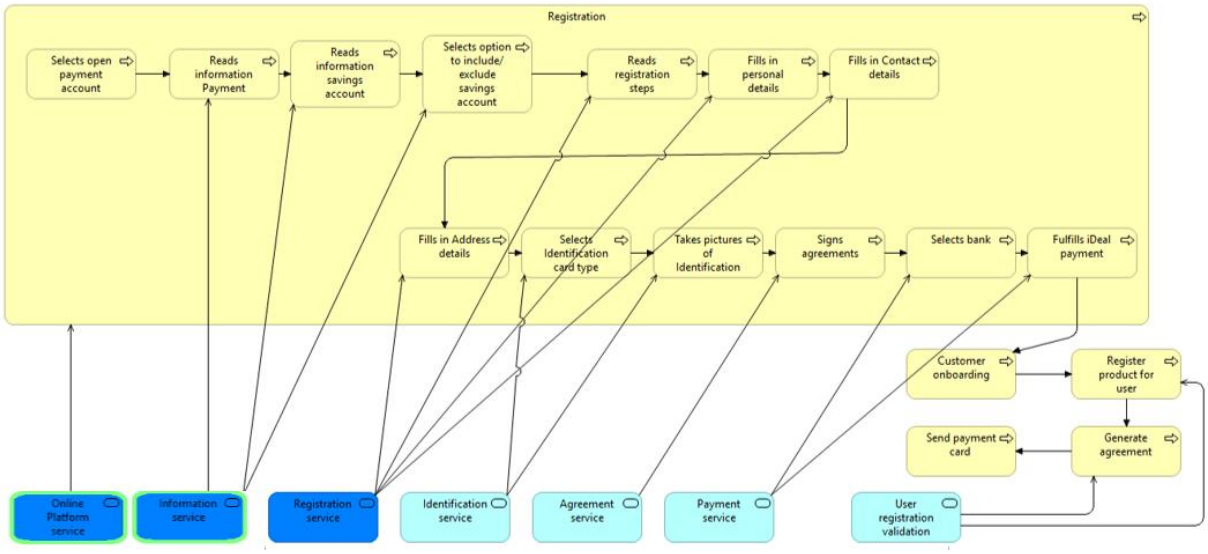

Figure 56 Application services layer TO-BE use case

5. **Describe the changes in the application components**
   The last step to complete the traceability architecture guidelines, is to describe the adjustments in the application components.
   a. **Describe adjustment in the existing application components**
      The following elements have to be adjusted in the application components: The front-end and the CMS. In the frontend, an option has to be included to select the preferred language and error messages have to be translated in multiple languages. In the CMS (Tridion), an extra field has to be included to include the translations for a language. ContextBank has indicated that it is time-consuming to check the translations. SDL (the supplier of Tridion CMS) has several service options given to translate:
      - Machine translation[7]
      - Translation software[8]
      - Translation services by SDL[9]

      In this way, employees can reduce the time to manually translate the content, and focus on checking the translations.
   b. **Describe new application components**
      No new application components are required to realise the multilingual support
   c. **Link application components**
      No new application components are realised, which means that there is no application component to link to application services.
   d. **Traceability**
      Assign the green traceability mark to the Online Front-end and the CMS application components.

   A visualisation of this step is given in Figure 57.

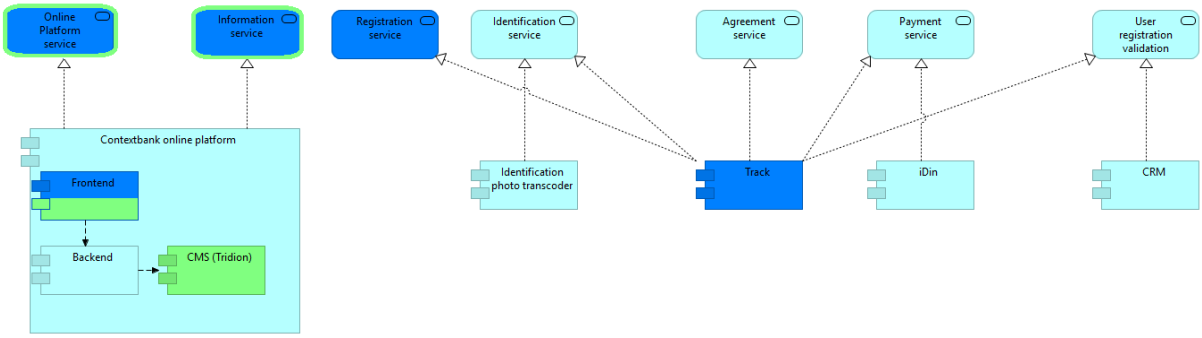

Figure 57 Application components layer TO-BE use case

Step 6: Implement changes in the system

After the To-Be situation is described, which includes the multilingual aspect, the backlog items have to be implemented in the system/application. When the improvements are realised, tested and accepted, the mobile banking application of ContextBank can go live and the mobile banking application will have multiple language support, information around the age restrictions to open a payment account and a date picker to select the age (including a minimum age restriction).

Step 7: Update documentation

Update the documentation of the registration process, so that all the layers of the journey, business services, business process, application services, application components and the descriptions around those elements are in line with the improved mobile banking application.

Step 8: Go back to step 1

After the mobile banking application and the document are updated, the To-Be situation of the registration process can be seen as the intended journey, persona and architecture. In this way, new elements can be improved based on event logs and new contextual aspects

[7] https://www.sdl.com/nl/software-and-services/translation-software/machine-translation/
[8] https://www.sdl.com/nl/software-and-services/translation-software/
[9] https://www.sdl.com/nl/software-and-services/language-services/

can be added to make a more personalised experience in the mobile banking application of ContextBank

Appendix B: Questionnaire

1. I would find the Contextual customer journey process simple and easy to apply

Strongly Disagree 1 2 3 4 5 Strongly Agree

2. I believe that the Contextual customer journey process will reduce the effort required to include contextual aspects into a customer journey

Strongly Disagree 1 2 3 4 5 Strongly Agree

3. TO-BE models specified by using the Contextual customer journey process will be easy for other analyst to understand and modify

Strongly Disagree 1 2 3 4 5 Strongly Agree

4. Overall, the Contextual customer journey process would be easy to use for specifying TO-BE models

Strongly Disagree 1 2 3 4 5 Strongly Agree

5. TO-BE models specified by means of the Contextual customer journey process, will make it easier for analyst to improve customer journeys and application architectures

Strongly Disagree 1 2 3 4 5 Strongly Agree

6. I can explain how to TO-BE models can be created by using the Contextual customer journey process

Strongly Disagree 1 2 3 4 5 Strongly Agree

7. Overall, I would find the Contextual customer journey process for specifying TO-BE models useful

Strongly Disagree 1 2 3 4 5 Strongly Agree

8. Overall, I would find the Contextual customer journey process useful to specify TO-BE models

Strongly Disagree 1 2 3 4 5 Strongly Agree

9. In my opinion, I would find it easy to understand TO-BE models after the they were drawn by following the contextual customer journey process

Strongly Disagree 1 2 3 4 5 Strongly Agree

10. I would definitely use the Contextual customer journey process to specify TO-BE models for including contextual aspects in the customer journey

Strongly Disagree 1 2 3 4 5 Strongly Agree

11. I found the application of the Contextual customer journey process clear and easy to understand

Strongly Disagree 1 2 3 4 5 Strongly Agree

12. Overall, I think TO-BE models drawn by following the Contextual customer journey process provides an effective solution for context-aware customer journeys

Strongly Disagree 1 2 3 4 5 Strongly Agree

13. Using the Contextual customer journey process would make it easy to analyse TO-BE models

Strongly Disagree 1 2 3 4 5 Strongly Agree

14. Users would be competent to use the Contextual customer journey process to specify TO-BE models in practice after reading the process/guidelines

Strongly Disagree 1 2 3 4 5 Strongly Agree

15. Overall, I think the application of the Contextual customer journey process is an improvement to specify TO-BE models compared to the current way of working

Strongly Disagree 1 2 3 4 5 Strongly Agree

16. I would intend to use the Contextual customer journey process to specify TO-BE models in the future

Strongly Disagree 1 2 3 4 5 Strongly Agree

Appendix C: Results MEM-questionnaire

		Subject code	
Question type	Question number	BA1	UX1
PEOU	1	3	3
PU	2	2	4
PU	3	2	3
PEOU	4	4	2
PU	5	2	3
PEOU	6	2	1
PU	7	3	4
PU	8	2	4
PEOU	9	4	2
ITU	10	2	3
PEOU	11	2	2
PU	12	2	4
PU	13	3	3
PEOU	14	1	2
PU	15	2	4
ITU	16	2	3
	PEOU	**2,66**	**2**
	PU	**2,25**	**3,63**
	ITU	**2**	**3**

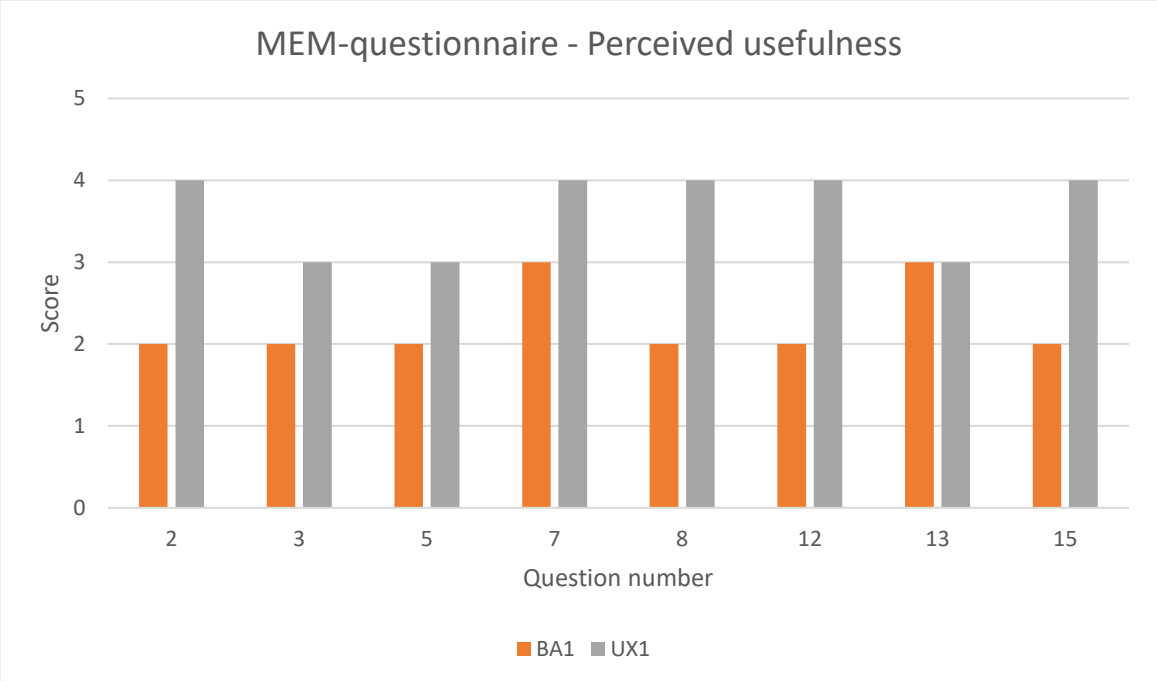

Figure 58 Questionnaire results Perceived usefulness

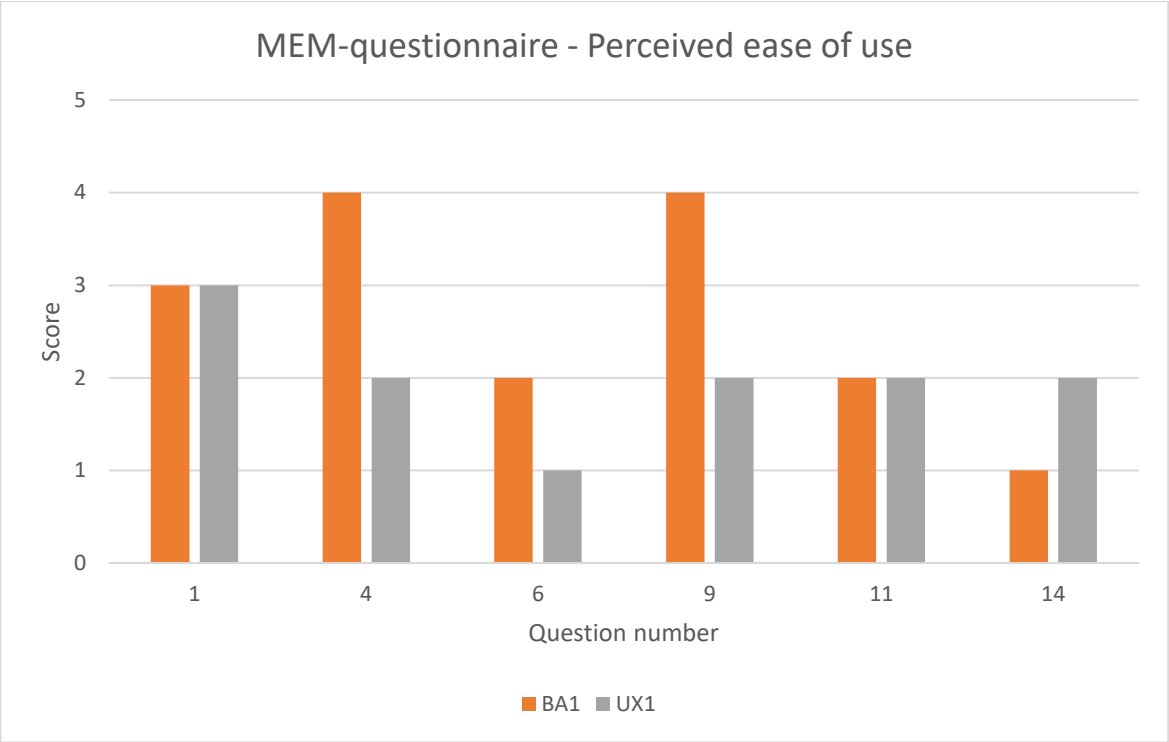

Figure 59 Questionnaire results Perceived ease of use

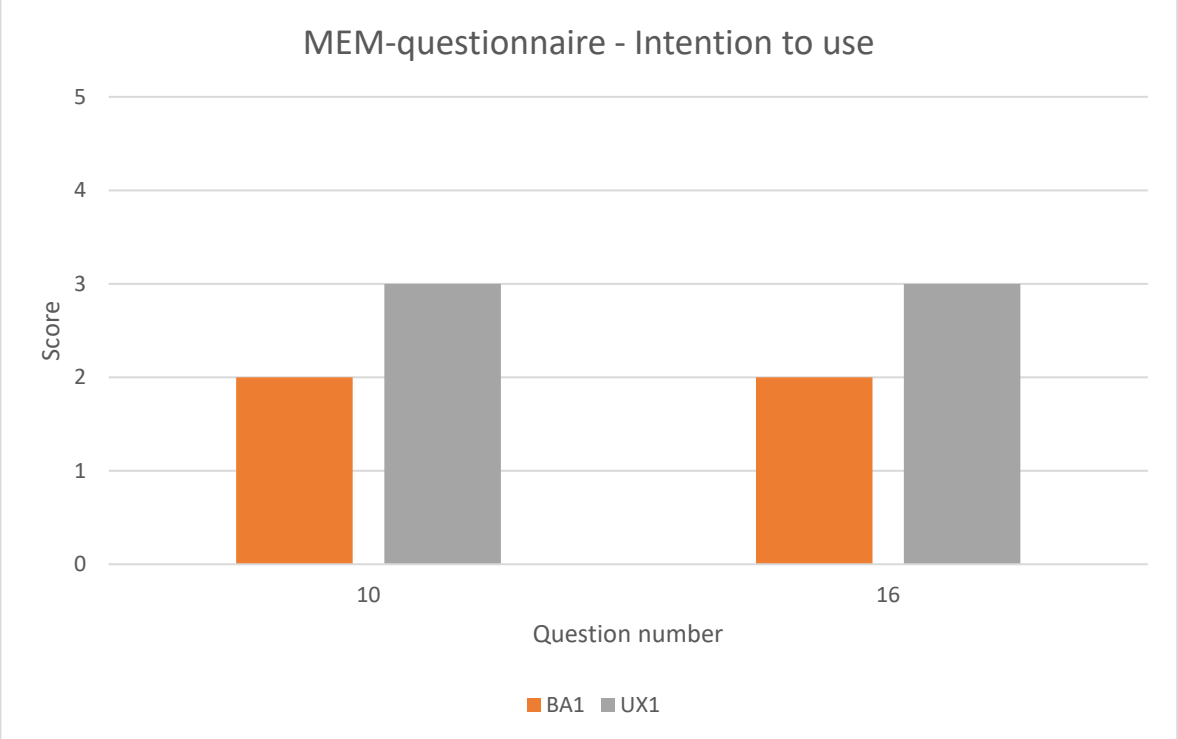

Figure 60 Questionnaire results Intention to use

Appendix D: Architecture guidelines

Guidelines to go from the customer journey to the application architecture

When the touchpoints are found which have to be improved in the customer journey, it is necessary that the foundation of the processes and application components which has to be improved/will be improved is described as well. When these aspects are not taken into account, it is not be possible to improve the customer journey itself. Lankhorst (2017) describes how elements of the customer journey are linked to the business process of the enterprise architecture. To describe the changes in the application architecture, the following layers are being described:

- Business services
- Business process
- Application services
- Application components

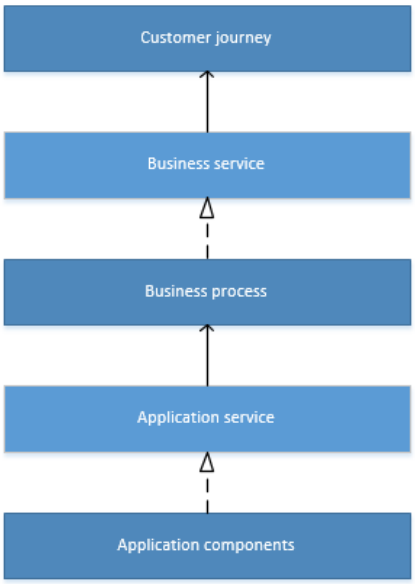

Figure 61 Mapping layers

This section provides a step-by-step plan how to describe the specific elements and components in each layer which are required to realise the customer journey. Also is described how the changes (based on the list with user stories from the analysis of the AS-IS situation) can be changed through these layers.

Guideline 1: From touchpoint to business service

To go from the touchpoints to the business services, the following steps are required:

Step 1. Link the customer journey and the stages to the business process. They are used later in a later stage of these guidelines (from business service to business process)

Step 2. Link the Persona, which fulfils the customer journey, to the business role

Step 3. For each touchpoint, create a business service which is used during the interaction of the customer with the organisation.

Guideline 2: From business service to business process

To go from the business services (which only includes the touchpoints) to the business process, the following steps are required:

Step 1. Describe for each business service (which is mapped to a touchpoint of the customer journey) which customer actions are fulfilled. These are assigned as steps in the business process.

Step 2. When the customer actions are described in the business process, then the organisation has to fulfil some internal steps before the interaction with the customer can continue. To visualise this interaction, the steps which the organisation/employee has to take between each process step of the customer (the touchpoints) has to be described. These steps are not visible for the customer. These steps are also called backstage actions

Step 3. When the backstage actions are described, some support processes can also influence the process (for example: The validation of registration details, payment cards etc.) which are not directly fulfilled by the employee who is interacting with the customer. These supporting processes are needed to deliver a service to fulfil the complete process.

Guideline 3: From business process to application services

To link the business process steps to the application services layer, the followings steps are required:

Step 1. Check for each process step which services are required to fulfil the process. Check also if one or multiple services are required

Step 2. Link the application service(s) to the process step by making use of the serving relationship link. In this way can be shown which application service(s) serve the business steps.

Guideline 4: From application services to application components

To link the application services to the application components, the following steps are required:

Step 1. Check for each application service which application components are used to realise the service.

Step 2. Link the application components to the application services by making use of the application realisation link

Step 3. Check for each of the application components which components are collaborating with each other.

Step 4. Link the collaborating application components by making use of the application dependency links

Appendix E: Contextual need guidelines

Contextual need guidelines

To define the contextual need, the following steps are required:

Guideline 1: Analyse the input

In this step, the contextual need is defined, based on input. The following steps are required:

Step 1. Several types of input can lead to changes/improvements in the customer journey and the descriptions of personas:

- *Business needs:* Based on the mission and vision of the organisation, a business can decide which contextual aspects have to be taken into account to improve the journey/experience of a user
- *Interviews/reviews:* Based on interviews (structured or unstructured) and reviews (positive and negative), problems/requests can be found, which are occurred by the users of the journey.
- *Journey problems:* A problem which has to be solved in the journey. If not, the risk exists that users goes to other organisations to fulfil their need(s).
- *Journey alignment:* Alignment over multiple journeys to support the same contextual aspects through the complete journey of the user
- *Comparison of personas with reality:* compare the elements on the persona with elements of a real user (also known as the 10+ UX description). Check which elements can be useful to include in the persona to improve the experience of the user

Analyse from one or multiple input(s) the contextual needs to include in the journey

Step 2. Based on the analysis of the input(s), define the contextual problem/need which has to be solved for the customer journey.

Guideline 2: Define requirements

Based on the analysis and the definition of the contextual problem/need in step 1 and 2, define the requirements. To define the requirements, take the following steps:

Step 1. Define the contextual requirements which are required to solve the problem/need. Include a code (like R1-R2 etc.), to make the requirement easier to trace.

Step 2. When the list of requirements is defined, structure the requirements by categorising them. Categorise the requirements in the following categories:

- *Stakeholder group:* Requirements for a complete user group
- *User Characteristics:* Requirements for users with specific characteristics. These characteristics contain more than one aspect (compared to the stakeholder group)
- *Personal goal(s):* Requirements which help to achieve specific goals of the user(s)

Step 3. After defining and categorising the requirements, define possible solutions which can realise the support of the requirements in the customer journey.

The above stated steps should be structured in the following way

Table 15 Structure requirements

Category	Functional requirement	Temporal change
Stakeholder group		
User Characteristics		
Personal goal(s)		

Guideline 3: Update persona

Based on the requirements and the temporal changes described in step 3, update the persona that the contextual aspect can be included. To realise this, the following steps are required:

Step 1. Define for the persona (which is used for testing the intended customer journey) which specifications are required to fulfil the described requirements to include the new contextual aspect.

Step 2. When information is not included in the persona yet, update the description of the persona by including the new specifications.

Step 3. To highlight which information is used to fulfil the new contextual aspect and which information is added to the persona, we add a traceability mark to it. Give the information which is used a green traceability colour/mark

An example of adding new contextual aspects in the persona and making them traceable is given in Figure 22.

Figure 62 Update persona, including traceability

Appendix F: Colour traceability guidelines

6. Colour traceability guidelines

Guideline 1: Describe the changes in the customer journey (touchpoints) (only applicable for the new contextual aspect. If event logs, go to guideline 2)

Describe the changes in the touchpoints based on the new contextual aspects in the customer journey or changes in the journey analysed from the event logs. A new contextual aspect does not directly mean that the customer journey is affected. If this is the case, go to guideline 2.

Step 1. Describe for the customer journey which touchpoints are affected by the new contextual aspect. Describe what changes in the touchpoint

Step 2. When a new contextual aspect is used in a customer journey, it is possible that new touchpoints have to be realised to support the new contextual aspect in the customer journey. If new touchpoints are required, describe what the function of the touchpoint is and where it is included in the customer journey

Step 3. Assign the traceability mark/colour to the affected/new touchpoints.

Green = new contextual aspect

Guideline 2: Describe the changes in the business service layer

Based on the new contextual aspect which has to be included in the journey or based the changes from the event logs, describe which business services are changing or which new business services have to be included in the business services layer. When a new contextual aspect is included, this does not directly mean that the functionality of a business service is affected. When there are no changes needed in this layer, go to guideline 3.

Step 1. Describe for the already existing business services (for the affected touchpoints) how they change

Step 2. When it is not possible to provide the new contextual aspect with existing business services for the existing touchpoints, it is necessary to include new services. Describe for the existing touchpoints the new business services and what services they deliver

Step 3. When new touchpoints are realised to include a new contextual aspect in the customer journey, describe which existing business services are needed. Link these business services to the new touchpoint. If a new business service is required, describe the details of the service and what is delivers.

Step 4. Assign a traceability mark to the affected/new business services.

Green = new contextual aspect Blue = Event logs

Guideline 3: Describe the changes in the business process layer

Based on the new contextual aspect or the changes based on the event logs which have to be included in the customer journey, describe how the steps in the process change or which new process steps have to be included in the business process layer. When a new contextual aspect is included or a new business service is realised, this does not directly mean that the business process is affected. When there are no changes needed in this layer, go to guideline 4.

Step 1. Describe for the AS-IS business process how the process steps change

i. **Onstage actions –** Describe the differences for the affected steps how the interaction(s) with the customer change
ii. **Backstage actions –** Describe how the interaction(s) for the employees who are interacting with the customer(s) change
iii. **Supporting actions –** Describe what changes in the interactions of other departments within the company which provides information to the employee who is interacting with the customer

Step 2. Based on the new business services or changes in the business process, it can be necessary to realise new process steps. Check for the onstage, backstage and supporting actions which new actions are required in the process. Describe for each new step the functionality, goals and responsible stakeholder to fulfil the process step.

Step 3. Assign a traceability mark/colour to the affected/new business process steps.

Green = new contextual aspect Blue = Event logs

Guideline 4: Describe the changes in the application services layer

Describe for the adjusted business processes if the existing application services have to be adjusted and if new application services have to be included in the architecture. When there are no changes needed in this layer, go to guideline 5.

Step 1. Describe which application services are affected by the changes due to the new contextual aspect. Describe for the affected application service(s) what changes (new functionality, separation of functionalities et cetera)

Step 2. When the existing application services cannot realise the new contextual aspects in the business process, it is necessary to provide new application services. For the new application services, describe the functionality of the services.

Step 3. Link the new application services to the existing or new business process steps which they support.

Step 4. Assign a traceability mark/colour to the affected/new application services.

Green = new contextual aspect Blue = Event logs

Guideline 5: Describe the changes in the application components

Describe for the adjusted application services if the existing application components have to adjusted and if new application component(s) have to be included in the architecture to realise the new contextual aspect or the changes based on the event logs.

Step 1. Describe which application components are affected by the changes. Describe for the affected application component(s) what changes

Step 2. When the existing application components cannot deliver the capabilities for the existing and new application services, it is necessary to provide new application components to realise the new contextual aspect or the changes based on the event logs. For the new application component(s), describe

Step 3. When new links have to be realised between existing applications, describe what changes in the information transfer between components. For the new application

components, link them to the application components where they collaborate with and describe which information is transferred.

Step 4. Assign a traceability mark/colour to the affected/new application components.

Green = new contextual aspect Blue = Event logs

Appendix G: Paper

The Customer is always right: Enabling Customer Journeys for Enterprise Architecture

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Abstract. Analysing customer journeys provides organisations to better understand the expectations of their customers, and to create an optimal customer experience. Academic and industrial evidences show that a customer journey supports contextual aspects, the chances that a customer buys a certain product they used before again increases. Some strategies improve the customer journey, but there is a need to face the challenge to quickly adapt to different customer contexts. None of the strategies provides support to align contextual aspects that supports or align the customer journey with the enterprise architecture. By facing these challenges, we aim in this study to design a process to support contextual aspects in a customer journey. The process supports enterprise architects when aligning customer journey with the contextual aspects and the enterprise architecture. This enables the process of the customer journey and realises context-awareness of the customer. We conduct this research in the context of a real-world use case at a Dutch banking business in order to evaluate our process in terms of stakeholders' perceptions. For the evaluation we conducted a focus group, which shows that the process is a structured and logical approach. The process gives a quick overview of the changes when including a new contextual aspect in a customer journey.

Keywords: Customer journey, Application Architecture, Contextual aspects, Traceability, Enterprise Architecture

1. Introduction

The customer journey is the process where the customer goes through when fulfilling a goal. Customer journey analysis is a systematic approach that helps organisations to understand expectations of customers to create the optimal experience [23]. An optimal customer journey will create competitive advantage and will support the customer experience objectives [11]. Customer journey is by definition a context driven approach, which allows to identify and contextualise patterns to promote best practices and establish organisational standards [5]. These patterns can be designed by organisations, by making use of customer journey mapping [16]. Several methods have been developed to gather requirements from a customer journey [24]. Some of them are intended to help organisations to understand the customer journey and how they can improve their operations and user experience [15]. For example, Bernard & Andritsos have developed a process-mining framework to compare the actual and expected customer journey [25]. They propose a process-mining model to bridge the gap between the actual and expected customer journey. Tseng et al. have developed a model to map the customer experience of a customer journey to improve the journey from the view of the customer [7]. Research shows that adding a multilingual context to customer experience provides organisations extra business value [12]. However, current frameworks do not utilise contextual customer journey analysis. When a context has to be included in the customer journey, a context-driven application architecture is required. In this way, the application architecture will enable services for the customer journey [26] with contextawareness for the customer [8]. We observe that enterprises face the challenge to quickly adapt to different customer contexts.At the moment, it is not described how to translate the improvements of the customer journey to the application architecture and how to the visualise the changes in the application architecture. We conduct this research in the context of a real-world use case. We consider the customer journey support of a company in the Dutch banking sector called ContextBank[10].

[10] To protect the privacy of the organisation, we make use of pseudonyms for the sake of readability calling the company ContextBank

To bridge the gap, this paper addresses the research question: *"How to design a successful process for contextual customer journeys?"*. To realise the contextual customer journey, we introduce the contextual customer journey process (see artefacts of the process in Figure 1).

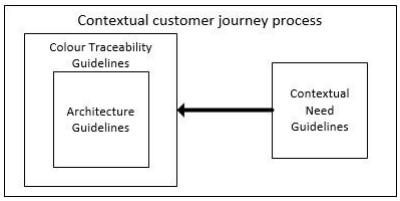

Fig.1. Contextual customer journey process Artefacts

the main goal of the process is to describe how an organisation can include contextual aspects in their customer journey and how to translate these into the application architecture. This process faces the following challenges:

- How to align a customer journey with the enterprise architecture (including explicit traceability);
- How to include new contextual aspects in a customer journey?

In this paper, we focus on presenting how to align a customer journey with the enterprise architecture. To pursue this research, we conduct the Technical Action Research by Wieringa [19]. In the remaining of the paper, we make the following contributions:

- Process description of the contextual customer journey process to include contextual aspects into a customer journey (Section 2);
- Enterprise architecture and customer journey guidelines, to visualise the impact of changes when including new contextual aspects into a customer journey (Section 2);
- Showing the possibilities and the applicability of the process through a use case in a Dutch banking business in the Netherlands (Section 3); and
- Present a validation of the process in terms of stakeholders' perceptions (Section 4)

2. Contextual customer journey process

A customer journey is the process the customer goes through when fulfilling a goal [24]. In this way, the customer wants to achieve a specific goal [20]. Controlling customer journeys allow organisations to manage the expectations and experience of a customer. When analysing customer journeys, organisations are able to better understand how a customer can have an optimal experience [13, 23].By using a systematic approach, an organisation can analyse the actual behaviour of customers to create an optimal customer experience [11]. Aligning the actual customer journeys with the expected journey provides such support [20]. To get an overview of the expected journey, organisation will map the customer journey by visualising the customer journey in documentation. The customer journey map defines the process which a customer would experience from the perspective of the customer [16]. Through customer journey mapping, organisations can create effective services, resulting in satisfaction for customers, increased revenue and lower costs for the organisation [21]. Based on the paper of Bernard & Andritsos [25] the following elements/components are used to map a customer journey: customer, journey, mapping, goal, touchpoint, channel, stage, experience and lens. A customer is fulfilling a journey in a context. A context is described as the implicit situational information of a system or organisation. It characterises the situation of entities that are relevant for interaction between user and application [13]. Context deals with places, people and objects.To specify the customer and the context, personas are used [14]. The persona describes the goals, abilities and interests of a representative user [18]. To enable a customer journey, an enterprise architecture is required. Enterprise architecture is defined by Lankhorst [26] as the "fundamental concepts or properties of a system in its environment, embodied in its elements, relationships, and in the principles of its design and evolution". An application architecture describes which applications are needed to fulfill the functional requirements, and their relations and properties. To include contextual aspects in a

customer journey, the following three elements should have alignment: Customer journey, enterprise architecture and context. For these alignments, the following gaps are found:

- How to include contextual aspects in a customer journey?
- How to translate from the customer journey to the enterprise architecture?
- How to realise traceability and visualisation in the customer journey and the underlying enterprise architecture when including new contextual aspect?

For this, we define the contextual customer journey process (see Figure 2) as an 7-step continouos refinement process to provide an overview of changes in a customer journey when taking contextual aspects into account. This process is build upon the process mining framework of Bernard & Andritsos [25]. The main goal of the contextual customer journey process is to ensure the satisfaction of the end-user goals based on the experiences (by making use of the event logs) and the context (by including contextual aspects) of the users. The process includes guidelines to describe the architecture of the customer journey, to describe the contextual aspects and to facilitate in the implementation of the architectural aspects for the TO-BE situation. The process also provides explicit traceability to describe the changes in the customer journey and the underlying architectural aspects. In this paper, we focus on colour traceability guidelines. The colour traceability guidelines will support in describing.

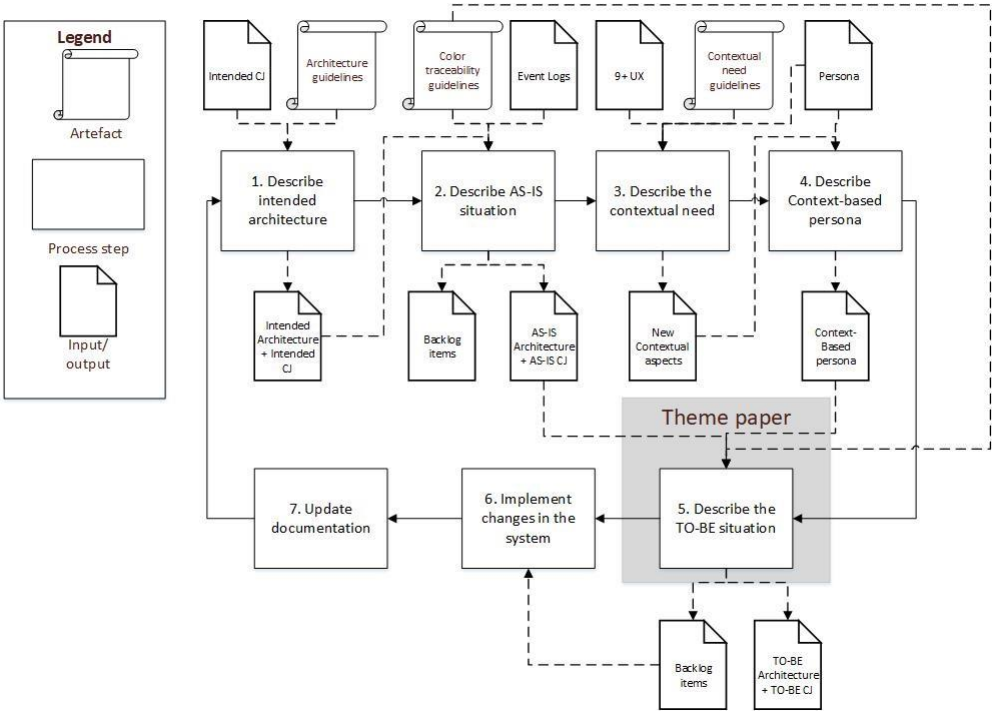

Fig.2. Contextual customer journey process

In the begin situation, we know three elements: The initial customer journey, the initial persona and the improvements in the customer journey based on the process mining framework of Bernard & Andritsos [25]. Step 1 is to describe the intended architecture of the customer journey. This can be realised by making use of the architecture guidelines. These guidelines link the customer journey touchpoints to the underlying business services. Furthermore the business process, application services and application components, which enable the customer journey, will be described/visualised based on the enterprise architecture modelling technique of Lankhorst [26]. Step 2 is to describe the AS-IS situation. The AS-IS situation describes the customer journey and the architecture when the improvements of the process mining framework are included. To visualise the changes based on the customer journey improvements in the underlying architecture, we make use of the colour traceability guidelines. After describing the AS-IS situation, the changes are included on the backlog. At this point, the customer journey does not contain any new contextual aspects yet. Step 3 is to define the new contextual aspect. Based on interviews, reviews, business needs, journey problems and real user comparisons we can define the contextual need

which will improve the experience of the user. Step 4 is to include the new contextual need in the persona (if not already described) . The new contextual aspect which is taken into account gets a traceability colour. The traceability colour is given to be in line with the traceability method of the colour traceability guidelines. Step 5 is to describe the TO-BE situation by making use of the colour traceability guidelines. After describing the changes for the TO-BE situation, we include the changes/improvements on the backlog. Step 6 is to implement the changes (backlog items) the system. Step 7 is to update the documentation of the customer journey and the architecture. After the fulfillment of these steps, we can go back to step 1 to include new contextual aspects in the customer journey. The updated documentation will become the new initial situation. An overview of the first 5 steps in the contextual customer journey process is given in Table 1.

Step 1: Describe the intended architecture **Input:** Intended customer journey, architecture guidelines **Description:** The intended architecture is the customer journey which is already described by the customer journey. Based on this customer journey, the architecture layers can be described (by making use of the architecture guidelines). **Output**: Description of the intended customer journey and a description of the elements in the intended architecture to realise the customer journey	**Step 2: Describe the AS-IS situation** **Input:** Intended architecture, Intended Customer Journey, Event logs, Colour traceability guidelines **Description:** By making use of event logs, the process of how the customer actually goes through the journey (compared to the documented journey) can be described. When making use of the colour traceability guidelines, we can describe the AS-IS **Output:** Backlog items (based on event logs), Documented AS-IS CJ & architecture
Step 3: Define the contextual need **Input:** Persona, Real user, Description 9+ Real User Experience, Contextual need guidelines **Description:** After the adjustments in the customer journey based on event logs, it is time to define the new contextual aspect by making use of the contextual need guidelines. **Output:** New contextual aspects	**Step 4: Describe the Context-based persona** **Input:** Persona, New contextual aspects, contextual need guidelines **Description:** Based on the contextual aspects items which are defined to fulfil the contextual need of the organisation, define how these affect the descriptions of personas to describe customers. **Output:** Context-based persona (including traceability)
Step 5: Describe the TO-BE situation After describing the new contextual aspects in the context-based persona, it is time to document the TO-BE situation of the customer journey. After describing the TO-BE customer journey, the TO-BE architecture can be described by making use of the Colour traceability guidelines. To describe the TO-BE situation, three sub steps are required: ***Sub step 1: Describe the changes in the TO-BE customer journey*** **Input:** Context-based persona, AS-IS customer journey, colour traceability guidelines **Description:** Check for each touchpoint if they are influenced or not. Check also if a new touchpoint should be added to the customer journey which is missing in the documented journey. This can be the case when a customer takes another extra step more often in the process. For the affected and new touchpoints by the new contextual aspect, make use of the same visualisation colour as in the context-based persona. **Output:** TO-BE customer journey ***Sub step 2: Specify the TO-BE architecture*** **Input:** TO-BE customer journey, AS-IS Architecture, Colour traceability guidelines **Description:** Based on the changes in the customer journey by the new contextual aspects in the persona (based on the contextual needs), describe which elements (based on the adjustments in the touchpoints) in the business service layer, the business process layer, the application services layer and the application components layer are needed to be changed or which elements have to be included to realise the TO-BE architecture. Fulfil these steps by making use of the architecture guidelines. Describe in a list of changes which changes are required to realise the TO-BE customer journey **Output:** TO-BE architecture, traceability links TO-BE, List of changes (based on new contextual aspects ***Sub step 3: Include the list of items on the backlog*** **Input:** Context based persona, TO-BE situation list of changes **Description:** Write down the contextual aspects on the backlog. Divide the contextual aspects in the following categories: Group, User characteristics and Personal goals. **Output:** Backlog items (based on contextual needs)	

Table 1. Steps Contextual customer journey process

In this paper, we focus on step 5. The reasoning to choose this step is justified by the fact that it has as input all the artefact results of the realised artefacts for the contextual customer journey process. We make use of the ContextBank use case to introduce the colour traceability guidelines, which involves the results of the architecture guidelines (the defined enterprise architecture) and makes use of the input of the contextual need guidelines (description of the new contextual need which has to be included in the TO-Be situation of the customer journey and the enterprise architecture).

2.1 Colour traceability guidelines

When the intended architecture is defined and the changes for the customer journey (based on the event logs/contextual needs) are described, it is possible to show which elements in the customer journey and the architecture have to be included to realise these changes before it is implemented. It can be seen as the assessment of the impact of changes. When an organisation changes its strategy or business goals, it can have a large impact on the structure, business processes and their architecture [10]. The impact analysis can help to decide in the need for a change [3]. When describing changes in customer journey and architecture, it is not only important to describe the changes and what the impact is: it is also important to make the changes traceable and to visualise them. Requirements traceability is the ability to follow the life of a requirement [2]. Requirements traceability saves effort and can improve the maintenance quality of software [22]. By visualising the traceability of the requirements, characteristics, patterns and trends can be discovered, due to the large amount of information which is visualised [6]. Several methods are described to make use of visualisation and traceability [17, 26]. For the colour traceability guidelines (which consists of 5 guidelines) which are used in step 2 (Describe AS-IS Situation) and step 5 (Describe TO-BE situation), we make use of the colours to visualise the changes based on

the event logs or the new contextual aspect. the architecture guidelines can be used to indicate the changes/impact on five levels in the enterprise architecture (see Figure 3).

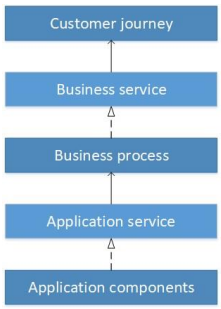

Fig.3. Mapping layers

By making use of these guidelines, the impact can be described in each level of the architecture and can also be traceable by making use of colour. The colour traceability shows which elements are impacted by the changes based on the event logs or the contextual aspect. Instead of one colour, like the impact of change analysis tool of Lankhorst [26], we make use of two colours: one for the event log changes (blue) and one for the contextual aspect changes (green). In this way, we enable categorisation in the traceability of the changes. The steps to describe the impact in each layer are aligned with the steps which are taken for the architecture guidelines.

To make use of the colour traceability guidelines in step 2, it is required that the architecture of the customer journey is defined and the changes in the customer journey based on the process mining framework of Bernard & Andritsos [25] are defined. To make use of the colour traceability guidelines to define the TO-BE situation, it is required that the contextual aspect which has to be included in the customer journey is defined and the persona, which is used to test the customer journey, includes the new contextual aspect. When making use of the colour traceability guidelines, it gives a quick overview of the changes which occur in the customer journey and architecture when improvements are made.

3. Use Case: Application of the colour traceability guidelines

For the evaluation of our approach in the contextual customer journey process, we conducted a case study. The case study was conducted in the context of ContextBank. ContextBank operates a software ecosystem of applications to support their information systems. This ecosystem is used by multiple organisations and delivers all types of services for Sales/Buying processes, service processes, marketing, bannering et cetera. ContextBank uses this ecosystem for communication with their customers. To let customers communicate with the bank, they make use of services of this ecosystem. One of the main goals of the bank is to provide their customers the most complete and ideal customer journey. The journey should be attractive and relevant. The main goal for the bank is to deliver a smooth 9+ customer journey. In beliefs of the bank, the 9+ journey is the only way customers will remain or become customer at a financial services provider. Products will become commoditised, and margins will drop on commodity products. The 9+ customer journey can be achieved by tuning applications, data and services to each other. Based on an interview with a business architect at ContextBank, they indicated that for example not all pages on the website are completely translated: There is a separate page describing the main aspects of the bank in the English language. To improve their customer journey, ContextBank wants to facilitate communication with customers by means of multilingual support. By realising this aspect, the bank

will get a multilingual system, which adapts language based on preferences of their customers. The main question for the bank is how an application architecture for the multilingual customer journey will look like. Based on an interview with a business architect at ContextBank, they indicated that for example not all pages on the website are completely translated: There is a separate page describing the main aspects of the bank in the English language. To improve their customer journey, ContextBank wants to facilitate communication with customers by means of multilingual support. By realising this aspect, the bank will get a multilingual system, which adapts language based on preferences of their customers. In this context, the ecosystem should consider modern expectations from all types of users, young and elderly people, banked or unbanked, digital natives or not, thereby focusing on the most relevant customer journey for all interactions and processes with customers on all relevant channels.

3.1 Registration journey

The customer journey which is used to include multilingual aspects at ContextBank is the registration journey (Figure 4). When a user fulfills the touchpoints of this journey, they have opened an payment/savings account and they receive a payment card. First, the customer will get an explanation around the types of accounts they can open (payment account and/or a savings account). After the account explanation, an explanation is given of the steps the customer has to fulfill to request an account. First, the customer has to fill in their personal information. Second, the customer has to take a picture of their ID for validation. Third, the customer has to sign an agreement, where the customer accepts the conditions to open a payment account at ContextBank. The last step the customer has to fulfill is that they have to fulfill an iDeal payment of 0,01 cent, to confirm their identity. After the four steps are fulfilled, the customer will receive a confirmation on the screen and the customer will receive an e-mail. After 2-3 days, the customer will receive a letter from ContextBank, including the payment card and the card details.

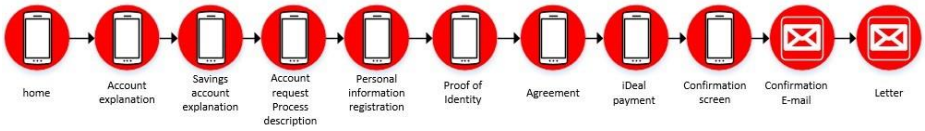

Fig.4. Registration journey ContextBank

To test the intended customer journey, ContextBank made use of the persona of Fadil. Fadil is a 25-year-old male student, who has a bank account at ITB Bank. At the moment, Fadil does not like his current bank, due to the fact they do not deliver everything in a uniform way. He wants to have a similar experience over multiple channels. The main problem which Fadil also had, was that he prefers to read everything in English instead of Dutch. The main reason for this, is that he masters the English language more than the Dutch language. A description of the persona, which is used by ContextBank, is given in Figure 5.

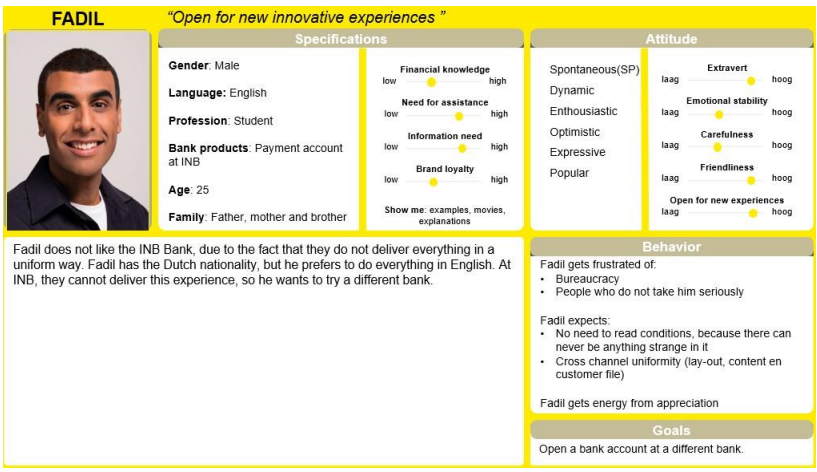

Fig.5. Persona ContextBank

The main problem for the registration journey is the language translation (see Figure 6). The Dutch translations in the mobile banking application of ContextBank are well described. When the user wants to switch to the English translation, the user will only see a partly translated Home screen (a combination of the Dutch and English translation) and it is not possible to fulfill the registration journey in English.

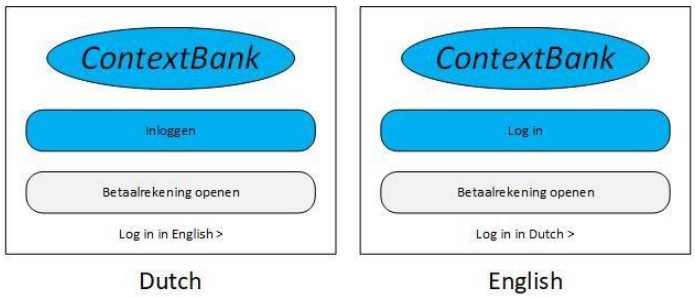

Fig.6. Initial situation registration journey translation

3.2 Step 5: Describe the TO-BE situation

We present the colour traceability guidelines for a top-down scenario. The guidelines facilitate in the visualisation and the traceability of changes when implementing new contextual aspects or process mining improvements in a customer journey and its underlying architecture. The input for using the colour traceability guidelines are the customer journey (initial or AS-IS), the architecture (initial or AS-IS) and the improvement (process mining improvement or the new contextual aspect). This chapter describes the guidelines which are used in the colour traceability guidelines. For each guideline, we will describe an example from the use case of ContextBank (see section 3) for implementing the multilingual aspect in the registration journey. Take into account that the process mining improvements from Step 2 in the contextual customer journey process are already included in the customer journey and the architecture.

Guideline 1 deals with describing changes in the touchpoints of the customer journey when the new contextual aspect has to be included. This guideline is only applicable for the new contextual aspect. The process mining improvements in the customer journey are already given by the process mining framework

Guideline 1: *Describe the changes in the customer journey (touchpoints)(only applicable for the new contextual aspect. If event logs, go to guideline 2)*

In our ContextBank use case, all the touchpoints of the registration journey are affected by the new multilingual aspect. The customer gets a translation in the application of their preferred language (Dutch or English), instead of the Dutch or partly translated English texts. Furthermore, no new touchpoints are included in the registration journey. The affected touchpoints by the new contextual aspect get the green traceability colour.

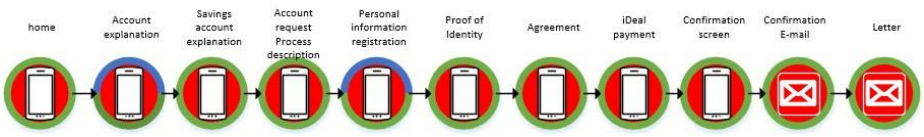

Fig.7. colour traceability guidelines - guideline 1

Guideline 2 deals with the affected business services when new contextual aspects are included in the customer journey. The guideline describes the affected business services (changed or removed) and if new business have to be included.

Guideline 2: *Describe the changes in the business service layer*

In our use case, the business services are not affected and no new business services are required to realise the multilingual aspect in the customer journey. This is because the functionality of the underlying business services towards the customer will stay the same. A business service will only change if it delivers extra services (for example when changes occur in an application process which require extra services) or new touchpoints are realised.

Guideline 3 deals with the improvements in the business process layer when new contextual aspects are included in the customer journey. It describes which business process steps are affected (changed or removed) and if new business process steps have to be included.

Guideline 3: *Describe the changes in the business process layer*

In our example, no steps are affected or have to be included in the business process of the registration journey business process when the multilingual aspect has to be included. This is due to the text is only translated. When other aspects are taken into account (like culture, ways of working, et cetera), when new services are realised or services are removed, it can occur that the business process steps change.

Guidelines 4 describes how to deal with the improvements in the application services layer when new contextual aspects are included in the customer journey. It describes the affected application services (changed or removed) and if new application services are required.

Guideline 4: *Describe the changes in the application services layer*

In our example, the online platform application service (which is used to run the mobile application) is adjusted. The application service is extended with multilingual support and an option to select the preferred language. The multilingual support also includes multilingual error handling. The information services is also adjusted, due to the translations of descriptions in the application. Further are no new application services included. The affected application services by the new contextual aspect get the green traceability colour.

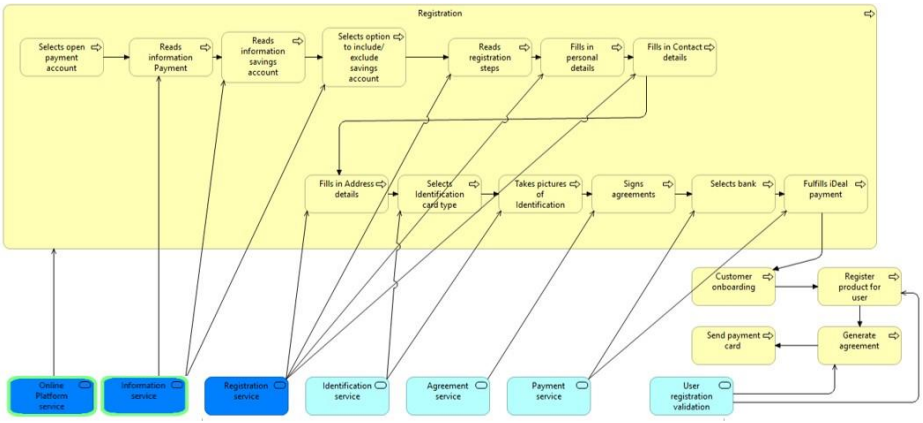

Fig.8. colour traceability guidelines - guideline 4

The last step, Guideline 5, describes how to deal with the improvements in the application components layer when new contextual aspects are included. This guideline describes the affected application components (changed or removed) and if new application components are required.

Guideline 5: *Describe the changes in the application components*

In our example, the front-end and the Content Management System (CMS) are affected. In the front-end, an option has to be included to select the preferred language and the error messages

have to be translated to include multilingual support. In the Content Management System (Tridion), an extra column needs to be created for each row for translation. Due to the fact ContextBank has indicated that translating content is time consuming, they can make use of the following services of Tridion to reduce the effort: Machine translation, translation services or translation software. Furthermore are no new application components required to realise the multilingual support. The affected application components by the new contextual aspect get the green traceability colour.

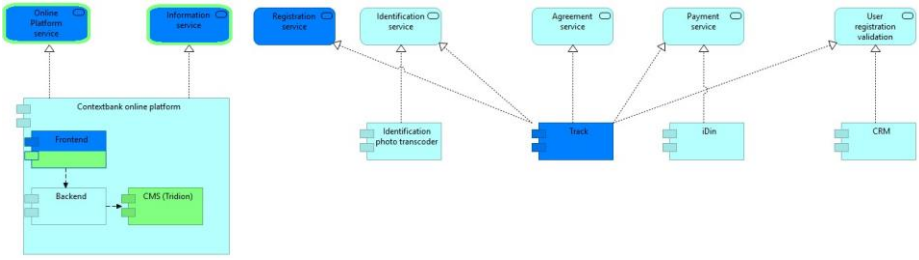

Fig.9. colour traceability guidelines - guideline 5

4. Validation: Focus group

To validate the results and the visualisations of the colour traceability guidelines which are used in the contextual customer journey process, we presented the process and the results to three stakeholders of ContextBank in a focus group [4]. The stakeholders were two business analysts and an UX-designer, who were not involved in the execution of the use case. The goal of the focus group was to identify the perceived usefulness, perceived ease of use, intention to use of the contextual customer journey process. For the colour traceability guidelines, we checked in the focus group the goals, operations and methods with the stakeholders for understanding and feedback for improvements. The validation started with discussing the initial situation of the registration journey at ContextBank including the problem statement. After that, the three guidelines which are used in the contextual customer journey process were discussed by making use of elements of the GOMS-model[1]: Goal, operations and methods. For the colour traceability guidelines, the stakeholders found that these guidelines create an easy overview of the changes when implementing new contextual aspects into a customer journey (”If an element has a different colour compared to other elements, you know that something will change in the architecture”). It will also create uniformity over departments, due to a structured way of working. The negative aspects were that the tool which is used within the organisation(s) supports the colour traceability guidelines and that departments should have a set of terms or have an agreement to create uniformity around terms, tools and techniques to work with (create an implementation strategy).

After the validation of the guidelines, we validated the complete contextual customer journey for the perceived ease of use, perceived usefulness and the intention to use (based on the Method Evaluation Model [9]. The contextual customer journey process was perceived as useful and easy to use: It was seen as a structured way of of working, which creates structure over departments and insights within the organisation. Due to the structure in the guidelines, the stakeholders found the process easy and efficient and it should improve the communication within the organisation (uniform structure). The main drawbacks for the contextual customer journey process were that everyone has to make use of the same structure (tools, techniques et cetera) within the organisation and that the process is not directly plug and play: The employees need training to learn to work with the process. Concluding, the contextual customer journey was received positively. There were some remarks about how the contextual customer journey process could not work, due to the lack of adaptation to fit within the organisation. This could be solved by realising an implementation plan to implement the contextual customer journey process over the departments within the organisation. The stakeholders mentioned: “there will be a uniform way of communication. The departments will have generic guidelines where they have to deal with. In this way, every department will have the same structure, instead of that each department fills it in by themselves”.

5. Conclusions and future work

Several ways are developed to improve a customer journey. This can be done by customer journey mapping and Process mining. Enterprises and organisations today face the challenge that they want to quickly adapt to different contextual aspects of customers in a customer journey. By using the contextual customer journey process, an organisation can describe how to include contextual aspects in their customer journey and how to translate these into the application architecture. By making use of the colour traceability guidelines of the process, the impact in the customer journey and the architecture can be defined and visualised. By making use of colour traceability with different colours, the impact can be visualised and categorised. To illustrate the colour traceability guidelines, we applied it in a Dutch banking business to visualise the impact when implementing the multilingual context in a customer journey. Validation in a focus group at the organisation shows the structured and logical approach, which gives a quick overview of changes which are required. But it would be desirable to have a uniform way of working and an agreement/repository about the terms, to improve communication. In the future, it can be evaluated if the contextual customer journey can be used with different contextual aspects and in other business sectors. For the colour traceability guidelines it can be checked if the colour is the most ideal way to map the impact of new contextual aspects or that different ways of traceability and visualisations can improve this experience.

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