



**The systemic change from the use of biographical evidence
of identity to a biometric self-service model of multi-modal
authentication**

**A case study of the paradigm shift in a Finnish government
agency's identity management**

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Abstract in Finnish

Olemme synnynnäisesti mukavuuden haluisia ja tutkimusten mukaan myös huonoja tekemään päätöksiä. Suhtaudumme epäilevästi kaikkeen uuteen, mutta kun jokin asia on meille tuttua, siitä on vaikea luopua. Muutosvastaisuus on luontainen ominaisuutemme, silti etsimme alati uusia asioita, jotka voisivat tehdä elämästämme helpompaa. Kun kyseessä on biometrisen datan käytöstä valtion viraston toimesta, me pelkäämme Orwell-maista dystopiasta maailmaa, jossa ihmisiä seurataan jatkuvasti ja vapautemme riistetään. Siitä huolimatta, että biometrinen data, joka koostuu meistä itsestämme, on tutkitusti turvallisempaa ja luotettavampaa kuin perinteinen biografinen tieto, meidän nimemme ja syntymäajat. Me avaamme älylaitteemme päivittäin käyttämällä biometristä dataa, mutta emme halua antaa sitä viranomaisille, vaikka tarkoituksena olisi parantaa elämäämme ja biometrian käytön ollessa tarkoin laeissa säädettyä. Paradoksaalisesti luotamme ulkomaalasiin älylaitevalmistajiin ja teleoperaattoreihin jakaessamme heille meidän biometristä dataamme, vain avataksemme kätevästi meidän rakkaat älylait-teemme.

Biometrian käyttö ei yleisesti ottaen ole ongelmallista sen käytön ollessa tarkoin säädetty laeissa ja kansainvälisesti velvoittavissa EU-asetuksissa. Näin ollen kysymys kuuluu kuinka valtiollinen taho voisi onnistuneesti ottaa käyttöön uutta biometristä teknologiaa, jonka tarkoitus on parantaa elämämme laatua sekä edistää identiteettimme turvallista ja luotettavaa käyttöä? Tämä opinnäytetyö tutkii muutosjohtamista ja systeemistä muutosta, joita valtion virastossa edellytetään vakuuttaakseen skeptisen yleisön, yhteiskunnan uuden palvelumuotoilukonseptin käyttöön ottamisessa, jossa on biometrinen teknologia ytimessään. Tutkimme opinnäytetyössä mitä toimenpiteitä tulisi tehdä, jotta vertaus kuvaannollinen monoliitti - biometrinen itsepalveluasema - voitaisi onnistuneesti ottaa käyttöön uudelle asiakaskunnalle - Maahanmuuttoviraston asiakkaille.

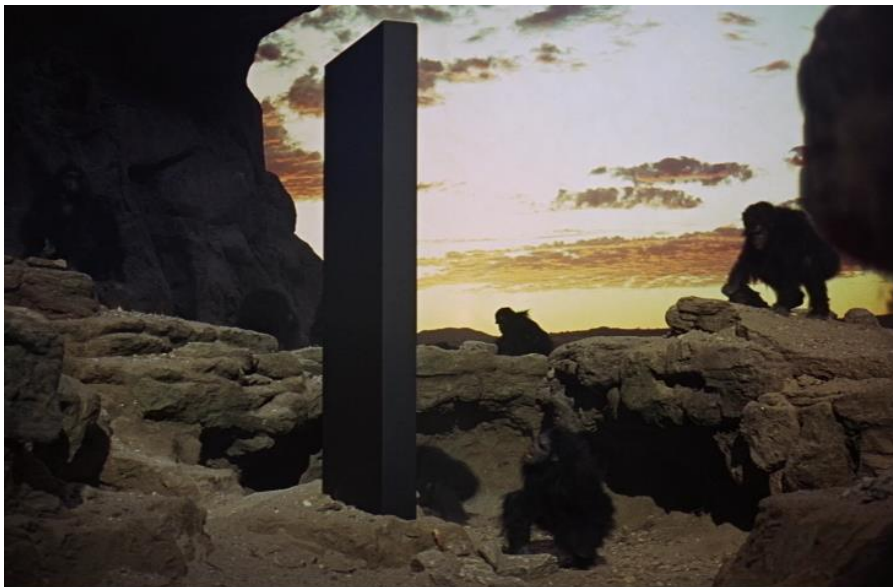
Abstract in English

We human beings tend to seek comfort, ease of use and are according to research are bad at making decisions. We are sceptic to new things, but when we become familiar and consequently attached to something it is very hard to give it up. Resistance to change is hereditary, yet we constantly seek new ways to make our lives easier. When it comes to the use of biometric data by a governmental agency, we fear a dystopic Orwellian world of constant monitoring and lack of freedom. Even though biometric data, we ourselves, is proven to be much more secure and reliable in identity verification than traditional biographical data, our names and date of birth. We open our mobile devices daily using biometric data, but we would prefer not to give it to authorities, even though the purpose is to improve our lives and strictly bound by legislation. Paradoxically we tend to trust vendors and foreign teleoperators in sharing our personal biometric data for the ease of use to access our beloved smartphones.

The use of biometric data within the government is generally not an issue and stringently restricted for governments alike. So how can a governmental agency effectively introduce a new technological innovation which aims to improve our lives and to make the use of our identities more secure? How can an agency convince both end-users and officials in the use biometric self-service kiosks? This thesis examines the transformational change a governmental agency requires to navigate in order to convince the hardened audience, the public in the use of a new concept of service design with biometric technology in its core. We will examine what are the steps needed to take to successfully introduce a proverbial monolith - a self-service biometric kiosk, to a new audience - the customers of Finnish Immigration Service

Keywords: identity, biometrics, innovation, systemic change, change management

The monolith from the movie A Space Odyssey acted as an inspiration and metaphor of change in this thesis.



The monolith from 2001: A Space Odyssey directed by Stanley Kubrick in 1968 (image by Londonist, 2017)

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1 Introduction

Not so long ago, people shopped in brick-and-mortar stores almost exclusively. We watched movies at theatres and programmes on television when they aired at a specific time of the day, with no options to alter the time of viewing. News were read on paper and only once per day on the day of publishing.

As time passed and technology advanced people started to interact with businesses and news agencies via their computers. The internet moved the physical stores and many services into the digital domain. As news moved online and the frequency of news increased from the former daily model people begun to migrate online. The time of the digital era had begun, and people sought more services online than in the physical realm. It became increasingly important for the web-based businesses and organisations to provide a customer friendly user experience and website.

Today, people have become most technologically enlightened requiring seamless customer experiences and intuitive services. Brick-and-mortar stores and paper-based news have prevailed but diminished significantly sometimes to the brink of extinction as they fail to meet the current fast paced demands of customer service. Contemporary services and consumer products can be ordered from a mobile device and sent to the doorstep all while people are at work or amidst an activity and totally independent to their physical location. Movies and television shows today are available at any given time and on any device. The standards have been set high by companies like Netflix and Amazon, and the customers expect the same level of services even from governmental agencies managing their personal information. People expect service design and a frictionless customer journey even from rigid governmental services, such as identity authentication and enrolment of biometric data.

Per definition the customer journey is the process a customer goes through when interacting with a company or agency, from initial awareness to post-purchase evaluation. It's essential for businesses to understand their customers' journeys to provide the best possible customer experience. A positive customer experience can increase loyalty, retention, and advocacy, leading to more sales, better reputation and ultimately a profitable business.

The times when a person was identified using traditional biographical information - their name in a brick-and-mortar store have all but gone. In today's digital age, biometric technology is becoming more prevalent in customer experiences, offering enhanced security and convenience. Identification is made through the verification of biometric data - the person themselves.

Biometrics in accordance with Merriam-Webster dictionary is referred to as “the measurement and analysis of unique physical or behavioural characteristics (such as fingerprint or voice patterns) especially as a means of verifying personal identity (Merriam-Webster 2023). The use of biographical evidence of identity, such as passports and driver’s licenses, has been the standard for decades. However, with the advancement of technology in the last decade a push factor has emerged towards multi-modal biometric authentication of identity, which has the potential to revolutionise the way we authenticate our identities. Biometric authentication and multi-modal authentication are exponentially more secure in verifying that the person claiming and identity is truly who they claim to be. This has not been the case for biographical information for long, as people with the same name and birthdate are count-less.

Multi-modal biometric authentication refers to the use of multiple biometric factors, such as facial recognition and fingerprint scanning to authenticate an individual’s identity. This technology offers a high level of security and accuracy compared to traditional biographical proof of identity, which can be easily counterfeited or stolen. Using more than one biometric identifier multiplies the likelihood that the person being identified is indeed the person they claim to be.

The shift towards multi-modal biometric authentication is a definite systemic change. It requires a significant shift in the approach to identity verification. Rather than relying on physical documents, individuals will be able to verify their identity through a self-service model utilising their biometric data - the person themselves. A self-service biometric kiosk, which will be explored in this thesis, allows in layman’s terms a person to authenticate most securely and reliably who they are in frictionless and in a short time, allowing them to make any transaction without the risk of someone impersonating them. This shift and systemic change have numerous benefits. For one, it offers greater convenience and accessibility, as individuals can authenticate their identity frictionless and quickly. This is particularly important in a world where most transactions are conducted online, remotely and world-wide. The reliable authenticated identity must be derived from somewhere. Multi-modal biometric authentication offers a higher level of security and fraud protection, as biometric data is unique to each individual and cannot be replicated or stolen in the same way as physical documents.

Despite the potential benefits of multi-modal biometric authentication, there are also concerns about privacy and security. It is crucial that the collection and storage of biometric data is done in a secure and ethical manner, and that individuals have control over their own data. Additionally, there are concerns about the potential for bias in facial recognition technology, which could lead to discrimination. The management of biometric data shall comply with supranational regulations, privacy acts such as the EU general data protection regulation, international standards and ultimately national legislation.

Overall, the shift towards multi-modal biometric authentication represents a significant systemic change in the way we verify our identities. While there are challenges to be addressed, the potential benefits are significant, and could lead to a more secure and convenient future for identity verification. As technology continues to advance, it is likely that we will see even more innovative approaches to identity verification emerge, and it will be important to ensure that these technologies are used in a responsible and ethical manner.

This thesis will, however, not focus on the technical advancements biometric technology has provided. Nor will it examine the policy of the use of biometric technology presents in contemporary society. It is evident that biometric data is very potent, and its use must be harnessed and controlled thoroughly. In fact, this thesis will examine the paradigm shift of the introduction of an unfamiliar advanced technology to a totally new audience - the customers of Finnish Immigration Service.

The time when uttering a name or personal identification number in person or by phone to so called securely identify an individual is ending, and this is a most welcome systemic change for both identity management, but also and most importantly for the individual themselves.

History is riddled with brilliant technological innovations which simply failed to meet their audience's demands. Equally, there are a plethora of technological marvels which have been harnessed to a totally different use than originally intended, unfortunately sometimes to even illicit and criminal use (King and Wincup 2008, Preece 2012).

In the movie 2001: A Space Odyssey (Cain47 2001) director Stanley Kubrick presents an apt analogy where a possibly highly evolved entity introduces something equally highly advanced - a monolith to a civilization which development is still in its infancy. Here the monolith is met with fear, curiosity, dismay and even aggression simply because the target audience cannot comprehend why they have received a monolith and what should they do with it.

In this thesis a monolith will be introduced. The innovation of a biometric self-enrolment kiosk, hereafter referred to as a SEK (self-enrolment kiosk), to the customers of the Finnish Immigration Service. The customer segment is worldwide and includes a significant representation of people from less developed countries. This thesis will examine the systemic change the agency has to go through in its transformation into a biometric era. However, it shall be noted that the customer is the central figure, not the technology and this thesis will closely examine the customer journey, customer experience and ultimately how the monolith introduced by the Immigration Service is received by its customers. It is worth to note that biometric technology reminiscent of the SEK has been in use at border control world-wide for nearly 2 decades. However, the eGates at the border serve a different purpose as they merely identify the person trying to cross the border using biometric technology. The SEK is a more advanced technological solution and indeed presented into a new environment.

To begin with this thesis will examine the agency and what is required for it to successfully navigate through a transformational change into a biometric era. There are several considerations to take into account and each step will be examined carefully.

Thereafter, this thesis will introduce and analyse the authentication of identity in contemporary society and the use of biometric data. After the close examination of the settings and current status of the use of biographical proof of identity, this thesis will focus on the monolith at hand, the self-service model of multi-modal biometric authentication of identity - the SEK, to be used by a new customer segment - the customers of Immigration Service. The consequent research will examine the use of the self-service biometric kiosk in real-life situation as a part of a project run by Immigration Service. Finally, the results will be examined, and a conclusion drawn if the monolith indeed has met a need originating from the customers or has it gone astray as in Kubrick's movie.

1.1 Abbreviations

ABC - Automated Border Control

CCTV - closed circuit television

eGates - electronic border control gates (= Automatic Border Control or ABC)

eID - electronic Identification Document

eMRTD - electronic machine-readable travel document

IPA - "Itsepalveluasema"

KPI - Key performance indicators

LIS - Lean Information system

MRTD- machine-readable travel document

Migri - Finnish Immigration Service

RFID - Radio frequency identification

SEK - Self-Enrolment Kiosk

1.2 Acknowledgements

According to the French philosopher and author Albert Camus, the literal meaning of life is to prevent oneself from committing suicide. Camus argued that life is inherently meaningless, and that the human experience is marked by an inherent sense of absurdity. In the face of this existential crisis, he believed that the only way to find meaning was to rebel against this absurdity, by embracing life and finding joy in the simple pleasures of existence. For Camus, the true measure of human worth was not in our achievements or successes, but in our ability to face the meaninglessness of life with courage and determination. Ultimately, Camus believed that the only way to live a meaningful life was to create one's own purpose, and to find value in the act of living itself.

The sentiment is that life may well be boring ever so often and to expect a constant stream of thrills and exhilaration. This is truer than ever before in the digital era where information overload is a daily phenomenon through digital media outlets and social media in its entirety. The thrill of receiving small and frequent doses of dopamine through the likes of cat memes on social media has all but replaced the monotony of life endurance. Yet, to endure what life has to offer and to overcome any adversities you will be presented with is to succeed in life.

I found value in life by evolving and studying rather than having a mid-life crisis, succumbing to self-pity, buying a motorcycle or hoarding cat memes. It may not be much, but here I am still.

2 A Transformational change into the digital era

In contemporary society innovation is not only seen as a key driver of organisational success but as vital for organisational survival. On the other hand, at a societal level innovation is

perceived as one of the key drivers of economic growth (Preece, 2012). Consequently, the question that needs to be asked is how is innovation and its underlying assumptions constructed; what are the consequences of these and what does this mean for the society?

In today's fast-paced and ever-changing world, the way we conduct business has transformed dramatically. We are living in a digital era where innovation and technological advancements are driving the economy, and organisations that fail to adapt to these changes risk being left behind. This transformational change has had far-reaching consequences, both positive and negative, for individuals, organisations, and entire society.

Transformational change is a process that involves making significant changes to an organisation's structure, culture, and processes to achieve a new level of performance or competitiveness. This type of change is driven by the need to adapt to new environments, respond to external pressures, and create new opportunities. The digital era has been a major driver of transformational change, with organisations increasingly leveraging digital technologies to innovate, streamline operations, and create new business models.

One of the key characteristics of transformational change is its systemic nature. This means that it involves changes to the entire system or organisation, rather than just isolated parts. Systemic change requires a fundamental shift in the way the organisation operates and interacts with its environment, and it often involves rethinking and redefining the organisation's purpose, values, and goals.

The digital era has brought about a systemic change in the way organisations operate. Digital technologies have enabled organisations to become more agile, innovative, and customer centric. They have also led to the creation of new products, services, and business models that were previously impossible. For example, the rise of e-commerce has transformed the retail industry, while the use of big data and analytics has revolutionised marketing and advertising. However, this transformational change has also had negative consequences.

The rise of automation and artificial intelligence has led to job displacement and widening income inequality, while the increasing reliance on digital technologies has raised concerns about privacy, security, and data protection. In conclusion, the digital era has brought about a transformational change that has had far-reaching consequences for individuals, organisations, and society as a whole. This change has been driven by the need to innovate and adapt to new environments, and it has involved a fundamental shift in the way organisations operate. While there are undoubtedly challenges associated with this change, it has also created new opportunities and possibilities for growth and progress. As we continue to navigate this digital era, it is important to be aware of the systemic nature of this

transformational change and to adapt accordingly. Even so, the discourse of innovation and the consequences of innovation permeate all levels of society, yet innovation is most difficult to de-fine. Consequently, this thesis' main approach can be reduced to three words; problems are solutions.

2.1 Corporate strategy

For an organisation to enable value in an integrated fashion it should rely upon pragmatic approaches and information management. This latter requires structured data collection and thorough analysis to produce actionable information for higher echelons of the organisation. Strategic decision-making should not be measured using short-term results or try to force a decision as fast as possible. In long-term it is about how well the organisation adapts its environment to itself and vice versa, a process of co-evolution (Beckford 2020, 70).

In Porter's five forces model (Porter 1980) he aids the organisation to identify its position within its environment and in relation to its competitors as well as the value chain of the particular domain. When the organisation seeks growth Ansoff's model (Ansoff 1987) gives an insight on the present and future market as well as potential emerging opportunities.

Future possibilities for the organisation can be found by Boston consulting group matrix (Johnson and Scholes, 2007) helping to understand future possibilities better. Even so, when turning to marketing strategy it all comes back to the management of information. Kotler and Armstrong (2013) highlight in their work the importance of analysing the information of the market environment and understanding the customer's behaviour. When designing a corporate strategy backwards starting from the customer, this process has much resonance.

In conclusion, despite having a robust corporate strategy, the folly lies in not looking forward and only reacting to events that have already occurred. This means taking action only after something has happened in the value-enabling activities and as a result of not actively scanning its environment effectively. As a result, tension is inadvertently created, and organisations begin to rely only upon the short-term analyses. Actions are drafted upon what happened previously in a prediction of what that particular incident may result in. This backward facing approach has the final outcome of an organisation not able to see what lays ahead. Firstly, for leaders to avoid such fallacy an information strategy is equally needed. The enabling power of an information strategy should not be undermined. Secondly leaders should accept that the future remains unknown, and everything may change. Leaving room for variation and interpretation of future development lowers tensions (between leaders and managers) and allows a more adaptive strategy to be implemented. Thirdly, the mission and

values of the organisation. Despite that many organisations focus on profit-making; it is the reason the organisation exists and its societal value which are of greater importance.

LIS as in lean information system - is by definition in which the decisions that need to be made at each point are understood and generate by themselves demand for contextualised information (Beckford 2020).

2.2 Systemic work with organisations

In today's rapidly changing business landscape, organisations are facing unprecedented challenges that require innovative solutions. To successfully navigate this complexity, a systemic approach to organisational change has become increasingly relevant.

Systemic thinking recognises that organisations are complex systems made up of interdependent parts that are constantly interacting and evolving. It allows us to understand the effects of connectedness in organisations and account more effectively for the dilemmas and tensions that arise during change.

A constructionist approach to systemic thinking focuses on how we collectively construct mental pictures of the organisation and its problems. By altering and renegotiating these understandings, we can find new ways of solving problems and creating more effective solutions. Problems become the solutions.

The field of systemic thinking has its roots in General Systems Theory and has been expanded in several directions since the 1960s. These ideas have become increasingly familiar as the field has developed, and the value of this approach is increasingly recognised in the business world. One important aspect of this approach is the idea of the Intelligent Organisation, first proposed by Anthony Stafford Beer (Martin & Rosenhead 2002) and further developed through theoretical and applied work since the early 90s. This approach emphasises the importance of autonomy and empowerment in addressing the continuously shifting balance of control, empowering individuals, and increasing responsiveness and immediacy in dealing with clients.

Understanding the value of information is essential to create a compelling business case for adaptation and to realise that value, which becomes imperative to ensure sustainability in the light of the challenge of mature markets and economic, social and technological change.

Systemic work with organisations involves a broad range of ideas and approaches derived from General Systems Theory and constructionist thinking. This approach recognises the interconnectedness of organisations and the need for innovative solutions that can adapt to the challenges of today's rapidly changing business landscape in the digital era. The

Intelligent Organisation is one such approach, emphasising the importance of autonomy and empowerment in creating more effective solutions (Beckford 2020).

Systemic perception entail that one is without judgement and does not contemplate about the situation. After all, judgement and opinions tend to intervene in many situations. To some extent systemic perception is going with the flow. According to Beckford an intelligent organisation “is rooted in a synthesis of behaviour, process and information in a structured set of processes which generate and enable value, maximise individual autonomy and, through a shared sense of purpose, nurture the identity (shared values and beliefs) of the organisation” (Beckford 2020:10).

In conclusion, an intelligent organisation is not about reaching all achievements the organisation has set out. Meeting the quotas and reaching goals are obviously defined measurements of the organisation’s KPI and part of its strategy (Beckford 2020). Subsequently, an intelligent organisation is about creating a set of structural, informational, and behavioural conditions which will allow the organisation to flourish and constantly evolve in harmony with its environment. An intelligent organisation is capable of meeting its current demands as well as proactively define future needs. However, this is only possible if the individuals of the organisation are free to do the right thing to the organisation, the customer and especially themselves. This non-conformant way of dissolving challenges synthesizes behaviour utilising intelligence-led policing to achieve organisational purposes, with great social and economic potential.

2.3 Managerialising innovation

Innovation tends to possess the capacity to contribute to corporate competitiveness, economic performance and environmental sustainability. In the contemporary digital era, innovation intelligence is transferred across borders and languages at an unprecedented rate, yet the ability to benefit from it seems to become more divergent among different organisations and countries. How much an organisation can benefit from innovation largely depends on how well innovation is managed in it. As such, there is a discernible increase in interest in the study of innovation management (Chen, Viardot, Brem 2019).

In the worst-case scenario organisations, when managerialist views are intensified and time pressures and profitability override most other organisational concerns reflexivity decrease and societal consequences of the management model and innovation that stretch beyond the agency’s immediate interest easily becomes suppressed, forgotten or underestimated.

The Charpie report, published in 1990, aimed to analyse the role of managers in promoting and controlling innovation within organisations (Charpie, 1990). The report argued that in-

novation was becoming increasingly important in the modern economy, but also that it was difficult to manage. Charpie suggested that one way to manage innovation was to "managerialise" it, bringing it under the control of managers.

At that time managerialising innovation involved a shift from a traditional approach, where innovation was seen as the domain of individual creative thinkers, to a more structured approach, where innovation was managed through formal processes and systems. Charpie argued that this shift was necessary because managers were better equipped to deal with the practical challenges of implementing and scaling up innovative ideas.

However, the report also acknowledged that there were risks associated with this approach. For example, there was a danger that innovation could become too controlled and bureaucratic, stifling creativity and flexibility. Additionally, there was a risk that managers would focus too much on short-term results at the expense of longer-term innovation.

Despite these concerns, the Charpie report had a significant impact on the way that innovation was managed within organizations. Many companies began to adopt a more structured approach to innovation, with formal innovation processes and dedicated innovation teams (Dedahanov, Rhee & Yoon 2017). While this approach has been criticized for its potential limitations, it has also been credited with enabling organizations to better harness the potential of innovation to drive growth and success (Johnson & Perez 2012).

2.4 Information architecture

Today, information is one of the most valuable resources for any organisation. With the abundance of digital data available, it is becoming increasingly important to manage it effectively. Information architecture is the practice of organising and structuring information in a way that makes it easy to find and use. It involves designing the information systems, processes, and tools that enable organisations to manage information effectively.

Information architecture is an essential component of an organisation's information strategy. An information strategy is a plan for how an organisation will use information to achieve its goals. It includes defining what decisions are needed to be made throughout the business and what information is required to enable them.

The importance of information architecture is particularly evident in the demand for a more customer-centric approach. Organisations must be able to access and use the right information to meet the needs and preferences of their customers. This requires a systematic approach to organising and structuring information, ensuring it is easily accessible and actionable (Spencer 2010). However, the creation of a new form of organisation, particularly

one that goes against traditional methods, can be a systemic risk. Resistance to change is a natural response, and the more an organisation opposes the status quo, the more likely it is to become one of them. Therefore, it is essential to approach information architecture systematically and strategically, taking into account the organisation's goals and values, and ensuring that it is aligned with the overall business strategy.

There is an evident demand to improve and develop processes to a more customer centric approach. Ever so often the search for new perspectives and methods of developing the organisation's processes requires to contradict the traditional methods. The creation of a new form of organisation in itself is a systemic risk. The more you oppose the conservative organisation the more likely you will become one of them. Furthermore, it risks polarisation where changes become labelled either good or bad (Stam and Hoogenboom, 2018).

In conclusion, information architecture is a vital component of any organisation's information strategy. It is the practice of organising and structuring information in a way that makes it easy to find and use, enabling organisations to manage information effectively. It is particularly important in today's digital age, where data is abundant, and a customer-centric approach is a necessity in order to thrive. However, it is essential to approach information architecture systematically and strategically, taking into account the organisation's goals and values, to ensure its success.

There comes a time when the impetus for an organisation to adapt a systemic change is imminent. A push for a paradigm shift in the working culture introducing a new and improved business strategy. In this case the introduction of a technological innovation. This thesis focuses on a single governmental agency, the Finnish immigration service, yet the scope encompasses the systemic change in identity management and the paradigm shift from the old-fashioned verbal identification of a person through uttering a name or date of birth is to become redundant. The use of biometric information, which by default is very much more secure in the use of identification will with all likelihood become most abundant. After all, it is customer-centric and provides a secure and most convenient customer journey. The research of this thesis is focused on identity management and the introduction of new technology to a new customer segment. Consequently, the research will ultimately focus on the most important factor of the customer journey, the customer itself.

2.5 Bias

When bias operates at the systems, or institutional level, it acts as a social force and instead of impacting people one by one, it affects many people. If a gender bias is disrupting the

balance of an organisation at the systems level, it can show up in a number of overt and subtle ways including:

When bias operates at the institutional or systems level, it has a broader impact and affects many people rather than just individuals. Gender bias, for example, can disrupt the balance of an organization at the systems level, leading to a number of overt and subtle effects.

Customer bias is any interpersonal bias that supports valuing some customers over others. For example, assuming that foreign people aren't good potential customers/clients/donors because they don't speak Finnish or have enough money. One form of bias is customer bias, which is any interpersonal bias that values some customers over others. This bias can manifest in different ways, such as assuming that foreign individuals are not good potential customers because they do not speak the same language or do not have enough money. This type of bias can result in exclusion and missed opportunities for businesses and organizations.

Another form of systemic bias is when a biometric device operating with facial recognition cannot recognise various ethnic groups. This is mainly the result of not using diverse facial images when training the algorithms operating the facial recognition. This type of bias may quickly lead into a "broader ethical questions around the potential proliferation of pervasive face-based surveillance" (Leslie 2020).

Institutional or systemic bias occurs when some groups maintain an advantage over others within a particular structure. This bias is the result of interpersonal bias that has become institutionalized or embedded within systems. For example, an organization may have policies or practices that disadvantage certain groups, such as women or people of colour, leading to a lack of representation and opportunity within the organization. It is important to recognize and address Institutional bias to create a fair and equitable environment for all individuals. This can involve implementing policies and practices that promote diversity and inclusion, such as creating diverse hiring panels or offering training on unconscious bias. Additionally, businesses and organisations can work to create a culture that values and embraces differences, promoting a sense of belonging for all individuals (Gilbert 2013).

In conclusion, institutional or systemic bias has a broader impact and affects many individuals within a particular structure. Customer bias is one form of interpersonal bias that can result in exclusion and missed opportunities. Recognising and addressing institutional bias is crucial for creating a fair and equitable environment, promoting diversity and inclusion, and fostering a culture that values and embraces differences.

3 The research problem

To fully understand the research problem and the impetus for the afore specified need to utilise biometric self-enrolment kiosks with immigration identity management the current problems will be defined. The use of the proverbial monolith, the SEK has not been previously done. Thus, most if not all research and subsequent testing of a SEK is treading on unknown grounds. For this purpose the reader will be guided through the jungle of the use of biometrics, which as the pivotal point of the research requires substantial considerations for a government entity to enable automated human recognition utilising biometric data.

The project management of the concept SEK is simply a mean to focus on exploring and finding the correct key to successful techniques of organising innovation. We begin by examining the core issue of authentication of identity before moving into the immigration service, the use of biometric data and what indeed is a SEK. Before examining the research, we shall examine how to achieve what needs to be considered to successfully implement the SEK to a new customer segment.

3.1 Authentication

In contemporary Finnish society identity proofing or authentication is mainly conducted through the use of biographical information. To prove who the person says he or she claims to be. The presentation of an individual's name, address and national identification number is commonly sufficient to establish a claimed identity reliably in most customer services. This method is evidently outdated and riddled with risks of mis-identifying an individual. Personal information such as name and address are quite simply to retrieve since postal information in Finland is public.

The national identification number is somewhat more difficult to obtain, yet it is not impossible. Having obtained an individual's name and address the consequent personal identification number follows suit and may be found. After all, the current national identification number presents both the exact date of birth as well as the biological sex of the individual. Acquiring these details with malicious intent may result in an identity theft (Rikosuhripäivystys 2023). A national programme revamping the national identification number has been ongoing for a number of years, yet it has not achieved to eliminate this problem regarding authentication or even removing the sex marker (Valtiovarainministeriö 2023, Digija Väestövirasto 2023).

Another flaw in the traditional model of identification is the minuscule monochrome image of the holder on a driver's licence or identity card. The driver's licence is commonly utilised as the means to authenticate an identity, despite its status not being accepted as an identity document (Henkilökorttilaki 2016, EU regulation 1157/2019). If the authentication is conducted by phone or a mobile device the phonetic uttering of biographical information is commonly sufficient and arguably an unreliable authentication is completed. In a physical authentication, where the holder is standing in front of the person trying to authenticate the presented identity, usually in a store or postal office, the actual verification of the information presented is seldomly conducted. Arguably the image of the holder on a driver's license is small, however, ever so seldom is the image compared to the holder leaving the authentication transaction as weak as if conducted per phone.

This model of authentication has an arguably arduously long historical burden and cultural tradition. As this has been the way to authenticate for so long, it requires a significant cultural and societal change to improve the authentication transaction. It needs something that the society would accept, as more convenient and better. Biometrics, such as face image and fingerprints provide a solution for this, which is widely utilised on smartphones and tablets and equally widely accepted.

3.2 Biometric authentication

Biometrics in accordance with Merriam-Webster dictionary is referred to as “the measurement and analysis of unique physical or behavioural characteristics (such as fingerprint or voice patterns) especially as a means of verifying personal identity (2023). Authentication is “an act, process, or method of showing something (such as an identity, a piece of art, or a financial transaction) to be real, true, or genuine: the act or process of authenticating something” (Merriam-Webster 2023).

In terms of biometric authentication, a reliable modality to authenticate a claimed identity is easily available. Finland uses biometric data comprehensively in its identity management and consequent travel documents such as the national passport, identity card and residence permit (ICAO 2021, EU 2017, EU 2019, Passilaki 2006, Ulkomaalaislaki 2004, Laki henkilötietojen käsittelystä poliisitoimessa 2021).

The prime biometric identifier, the facial image of the document holder, is found on all afore mentioned travel documents, both visible in the visual inspection zone and encrypted on the RFID chip embedded in the document's polycarbonate substrate or cover material (ICAO, 2021). However, outside the space of border control and automated border control gates (ABC

or eGates) the use of the facial image is uncommon, and when used it is mainly in manual comparison. A manual comparison is where the person attempting to verify a claimed identity visually compares the facial image presented of the holder on an identity document to the person in front of them. This process is most subjective, intrusive, and ultimately arguably unreliable.

It has been established that the use of biometric data in an automated verification process is much more reliable than the traditional use of biographical information and a requirement by the European Union (2004). The use of biometrics in travel documents and consequent identity management has been increasing steadily in recent years. The pandemic has supported the use of contactless biometric verification having several benefits, particularly in hygiene. The use of automated biometric comparison to authenticate a claimed identity is a more robust model than manual comparison. Equally beneficial is using multi-modal authentication combining biographical information with biometric to establish a reliable proof of identity as required by legislation and regulation (EU 2004, EU 2017, EU 2019, Passilaki 2006, Ulkomaalaislaki 2004, Laki henkilötietojen käsittelystä poliisitoimessa 2021, Laki henkilötietojen käsittelystä maahanmuuttohallinnossa 2020).

In addition to physiological biometric data behavioural biometric include techniques which can be measured and identify the individual to a recorded template. These may be analysis of keystroke, mouse dynamics, gesture dynamics, signature dynamics and gait, - the personal style of walking. The term behavioural biometrics excludes what is normally understood as behaviour that can be controlled by the human will to a higher extent. This refers to behaviour, such as shopping, browsing history or the content of communication (Franks & Smith 2021). As far as such behaviour is analysed to infer conditions of a genetic, physical, physiological, behavioural, psychological, or emotional nature characterising a particular individual (Ekman, 2007), it is necessary to note of its existence even if it is not further examined in this thesis.

In conclusion the use of biometrics in authentication may bare connotations to criminal investigations where identification of an unknown perpetrator is conducted using biometric samples such as fingerprints or DNA. Thus, the use of biometrics, especially DNA may be frowned upon since DNA, for example, has the potential to reveal more information of an individual than intended. This may include hereditary diseases, parenthood, genetic ancestry, and much more sensitive personal data. Consequently, presenting biometric data to authorities seems to be somewhat controversial despite a plethora of supporting legislation and standards. Paradoxically people have little to no objections in sharing their biometric data (fingerprints, facial image and voice) with foreign private companies in order to access their mobile device

on a daily basis. Sharing biometric data with a foreign telecommunications operator which integrity is unknown and does not necessarily comply with the European GDPR seems not to be an issue in order to have easy access to a personal handheld device. Thus, trusting a telecommunications operator is more viable than trusting the government issued and sponsored identity. This collective action is a reminder of the Mertonian theory of unanticipated consequences of purposive social action (1936). As a result, the use of biometrics is widely applied, but there are reasonable concerns when governmental agencies apply the use of biometric authentication on people. This stigma needs to be addressed and openly communicate to the public how biometrics are indeed utilised within a state or governmental agency.

3.3 The Finnish Immigration Service

The Finnish Immigration Service, hereafter referred to by its abbreviation, Migri. Migri is a governmental agency within the Ministry of Interior of Finland. It is a decision-making organisation to applications of immigration, asylum, refugee status and citizenship. Within the year 2022 Migri had taken more than 180 800 decisions regarding residence in Finland (Migri, 2022). Migri is also the responsible authority for maintaining reception system and respective reception centres to host asylum seekers and refugees alike.

Migri implements the Finnish immigration strategy and promotes controlled immigration, good administration, and human and basic rights (Maahanmuuttoviraston organisaatiostrategia 2023, Ulkomaalaislaki 2006, Laki henkilötietojen käsittelystä maahanmuuttohallinnossa 2020).

The Finnish Immigration Service provides specialist and information services in support of political decision-making and for national and international cooperation. The Finnish Immigration Service participates as a specialist in the discussion about immigration. Migri is also a forerunner in digitalisation and the implementation of technological developments which aim to improve the overall security of immigration as well as improve the quality and speed of the decision-making processes.

3.4 Biometrics in Migri

Biometrics as a term has its root in ancient Greek where bio meant human and metrics to measure. Consequently, the term biometrics refers to the measurement of biological systems of a human being. As established in this thesis, biometrics refer to unique physical, physiological, or behavioural attributes of the human body all capable of identifying an

individual. Biometric identifiers include the perhaps most common fingerprint and facial image, both which are standardised and used in Finnish Immigration Service for identification.

Facial recognition has in the recent years become the most prominent method of biometric authentication and predicted to experience the largest growth rate over the next few years (Biometrics Institute 2023). Biometric systems conduct and use the biometric data, the templates collected from an individual to automatically compare the biometric data samples against previously collected digital information from users. Biometrics identify people by measuring a specific feature of individual's anatomy, physiology, a skill, a behaviour, or a combination of these things (Anderson 2020).

The Finnish Immigration currently utilises biometric data for secure authentication and in an effort to mitigate against enhanced sophistication of criminal activity and the complexities of a digitally connected world. The immigration Service establishes a claimed identity of an immigrant using biographical and biometrical data in order to solidify the claimed identity and to be used in Finland. Despite public reservation of a governmental agency using biometric data the proliferation of the use of biometric data in the private and public sector has increased dramatically. Most if not all mobile devices may be accessed utilising biometrics - fingerprint verification or facial comparison for security access control.

Biometric technology is rapidly developing increasing its speed and capabilities in correlation to computational process speeds. The increasing modalities of biometric identifiers further increase its expansion. Automated biometric identification is rapidly becoming the primary method of authentication in the digital realm. Traditional use of usernames and alphanumeric password combinations are becoming obsolete, as determined in the previous chapter. Criminals have found numerous methods of compromising this method for security access control (Europol 2023). Equally the constant requirement of network security to reset the combinations have made it difficult for users to manage their access control and to securely store and access the passwords documented lest they forget. Biometrics provide a more secure solution leaving the usernames and passwords redundant as biological attributes are more secure means of identifying themselves. Identity crime and misuse of personal information remain a grave concern in Migri. Financial losses continue to rise in the society despite improvement in identity proofing and the consequences impacting national security which both are most difficult to trace back to identity crime and misuse of identity.

3.5 The concept - SEK

The use of self-enrolment kiosks, the SEK, is a concept designed by Migri in order to enable the customers of Migri to prove their identity using a self-service kiosk, which is placed in a secure and controlled environment such as a Migri's office for customers. Furthermore, a human operator is designed to be constantly supervising a SEK or SEKs. This 2-factor security ensures the interaction with the SEK is performed securely and without risk of tampering.

The physical environment is to be secured, and access controlled. If a SEK would be located unsupervised in a public area there would be limited options in mitigation of manipulating the proofing of identity. Consequently, the process of authentication would become unreliable and unusable for the purposes of Migri. Thus, the combination of a secure area, technical monitoring such as CCTV and the human operator supervising the operations of a SEK will mitigate effectively most if not all types of attack vectors against the SEK and the subsequent identity proving process. This is designed to result in the effective mitigation of manipulation of the SEK is made such digital injection attack (iProov 2023). Equally presentation attacks (NIST 2023) shall be negated through the use of an on-premises officer constantly monitoring the use of the kiosks.

The human operator is extremely effective in recognising methods of concealment the SEK may have difficulties with, such as injection attack, the use of 3D-facial masks, rubber fingertips or false hands. All intended to spoof the SEK and introduce false biometric samples to the Immigration Service database. In fact, the human operator has two tasks to conduct. The first and foremost is to a customer service operator assisting and advising the customers in the use of a SEK. In problem situations the operator may resolve an issue, direct a family to orderly use the SEK and if needed refer the customer to a desk officer. The second task is less visible as the human operator functions as a profiler. As in many stressful situations emotions may leak through the body, the face and the voice (Ekman 2007). Stress may be induced if a customer has ill intent and aims to spoof the SEK. A skilful profiler may recognise these emotions and clues and consequently address the customer to elicit further information of the reason for stress. Not all persons who are stressed have ill intent. However, the human operator may well be able to profile and address a customer who has ill intent and refer him or her to further examination or interview.

The use of SEK enables fast and reliable verification of Identity with the option of self-enrolment of biometric data, more specifically fingerprints and facial image. It links the holder of the travel document to its legal holder thus eradicating the need for manual verification of identity and forensic document examination. A SEK operates in mere seconds and its scalability

to serve large numbers of customers is virtually limitless thus alleviating the pressure on the queuing system to a human operator. The combination of new technology, self-service biometric data utilisation and service design is the product of a comprehensive service model where customer experience is critical, but with security in its design. In the SEK model there are very few weaknesses as to identity management. As a result of the technical design of the SEK it is capable of achieving a high level of identity proving in seconds that a human being could not do in a longer time span. Identity proving is the core function of any human related process involving one's identity and consequent sensitive biometric data.

This thesis will continue to examine the systemic change process and the paradigm shift in the use of automated biometric verification of the Finnish Immigration Service. In the centre of this thesis is the SEK, which aims to enable the use of SEKs in the Immigration service customer service. However, the questions remain what needs to be done to successfully implement a SEK with a new customer segment?

3.6 A systemic change - are we there yet?

The systemic change from biographical to biometric discussed in this thesis is yet to fully commence. The use of biographical information is still deeply ingrained in society. Arguably a historical remnant from the time when all people in a village knew each other and there was no need to prove their identities.

The impetus to shift from the solemn use of biographical data is evident as identity thefts thrive world-wide (Europol 2023). The use of biographical information, the knowledge based verbal sharing of a PIN - a personal identification number or to use a signature to reliably ascertain a person is indeed who they claim, is a societal burden carried with us from the past. As a result of this insistence of using out of date methods of identity proofing leaves people with difficulties in identifying themselves and to protect themselves from identity thefts. Subsequently, people are forced to share abundant personal information to convince an authority of who they are. People are required to carry with them official documentation proving their identity, such as passports, identity cards or residence permits. However, the manual verification using an identity document is, as discussed, neither reliable, non-intrusive and is highly subjective. People are forced to use online seemingly unlimited number of passwords to be allowed access to sites requiring secure identification to avoid identity theft with limited success (Europol 2023).

India is among the top four nations world-wide who suffer from cybercrime and identity thefts. Research has found that India's most used passwords include "password", "123456" and

“googledummy”. Despite the rampant cybercrime 73 % of 2022 where the same as in 2021. And most concerning of all 2022 passwords 83 % where possible to crack within 1 second (Nayak 2022). Nevertheless, if these passwords are misplaced or hacked online it leaves the identity of these people compromised risking identity thefts and numerous economic ramifications. The re-establishment of an identity after an identity theft, renewing all related personal documentation and official information is a time-consuming and cumbersome process.

What stops governments and agencies from effectively utilising biometric data, if it is proven to be more secure and more customer friendly than biographical data? Clearly the public has accepted daily use of biometric access management to a mobile device with little concern of the possible consequences. If a state authority or an agency plans to introduce the use of biometric data for proof of identity for their customers, such as automatic facial comparison or fingerprint comparison to verify an identity securely, reliably and fast, the acceptance is low. The reception may well be even hostile, particularly, if another biometric sample such as DNA or iris is proposed. The society seems to react to biometric identification employed by the state with sentiment of Orwellian states and dystopian views of non-existent privacy (Orwell 2008).

In conclusion biometrics is proven to be a very reliable method of authenticating a human being. It can be non-intrusive, is usually very hygienic and most often very fast and customer friendly. Yet, the use of biometrics by governments is not widely approved beyond border crossing. As any powerful tool, biometrics can be harnessed to both good and evil. Biometrics, especially the use of fingerprints is often stigmatised as it bares connotations to crime investigations, biometrics may well be a solution to the increasing legal immigration and constant great flow of asylum seekers to Finland, which places continuously strain on the license administration and customer service. The current geopolitical landscape has further escalated this predicament and improvement in the application process is in dire need.

The solution presented in this thesis using self-service biometric enrolment and identity verification aims to address the core issues involved in both legal migration and asylum claims. In this model the customer experience is the most important aspect and biometrics in its core. The desired outcome is to convince the customers of SEK that usability triumphs over technology. Not a monolith, but service design at its best. However, this thesis examines the systemic change and paradigm shift in order to be able to achieve the desired outcome and the willingness of the new customer segment to accept the monolith.

3.7 Research question

Per definition the research question is the beginning, body and end of all research. It acts as a guide to the researcher in their decision-making, and determines the type of research, the strategy and sample (Tuomi & Sarajärvi 2002, 70). In practice, a researcher uses the research problem to crop the area of study and focuses on the main points that are of interest in this particular study, making decisions that are true to the original goal.

The research question is two-folded implementing both a security-by-design approach, where identity management and secure and reliable use of biometric data are the main facilitators of the concept - authentication as a service. Equally important is the service design approach with the customer journey in the centre. A smooth and frictionless customer experience proving their identity in a self-service function would enable the full functionality of the SEK concept. The process described is a digital transformation, which is no longer a mere initiative or hype. It has become a mandate for organisation's regardless of industry to become a technology organisation in order to survive in the modern digital economy.

The research question ultimately originates from the end-product, the customer. In this case a customer of Migri and a subsequent immigrant to Finland. This model of effectively designing backwards from the customer to achieve desired outcomes is based in theory, where integrated coherent information is utilised for a competitive advantage enabling synthesis of behaviour and processes (Beckford 2020). Consequently, the research question is aimed at the customer with the introduction of new technology into the customer journey. The introduction of SEK into Migri's service centres in order to facilitate a smoother customer experience.

Ultimately it is not what technology can do for the customer, but rather the systemic change of policy and process design how they can utilise effectively and securely technological solutions to benefit the customer. If the research was to fail the SEK would become a monolith, shunned, and avoided at all costs. If successful, the SEK would become a household name in immigration licence processes. However, despite the obvious goal of a successful implementation of SEK in Migri, this research focuses on the process itself and objectively examines how this technological innovation is received by the designated new customer segment.

By design the SEK presents a most secure and reliable method of self-service identity proofing and enrolment of biometric data in accordance with national legislation, EU-legislation, and international standards applicable. Nevertheless, this aspect of security-by-design is neither addressed in detail in this dissertation, nor should it be as the main focus lays on the

customer's experience of using a SEK. Depending on the outcome of the users' experiences of SEK the design of the entire project may be amended to suit the desired outcome better.

3.8 What the research seeks to answer

The application process for various types of residence permits in Migri is a tedious process. Leppänen (2022) pointed out in her service design approach that the customers of Migri tends to suffer from slow processing of applications, cumbersome bureaucracy, and lack of transparency of their personal application process. A particularly difficult phase of the process is the lengthy queues to personal customer service in order to expedite applications. These queues have extended to over several months in 2023 with a time limitation of 30 minutes allocated time slot per customer. During this allocation of time the officer has several tasks to conduct in relation to the application of a permit. First and foremost, identity proofing must be conducted. It is paramount that the officer can reliably authenticate the customer's identity, that their travel document is not falsified and that the travel document is indeed in its rightful owner's possession. For this purpose, a nationally accepted passport or a Migri issued residence permit are the only viable documents accepted for identity proofing in accordance with legislation and international standards (Ulkoministeriö 2023). This process of manually confirming a presented passport's authenticity and with its rightful owner is cumbersome, time consuming and forensic examination of any document should not be conducted under the watchful eyes of a customer.

The traditional service model operating at a counter with human interaction to all relative aspects of the application process is arguably outdated. As a result of in-house research, development and innovation by Migri the SEK-concept has been defined. The concept has been specifically developed to answer to the needs of the agency and its customers. SEK is of high security by design yet is has the capability to be scaled to vast numbers of customers. As the traditional human interaction service takes 30 minutes, the SEK is capable of establishing an authenticated identity within mere seconds. Equally the SEK is able to enrol the biometric data of a customer which are required for their application, and finally process their payment of their services.

Customers of Migri believe that an initiative such as SEK could increase the customer experience and especially increase speed and scalability of the application process dramatically (Leppänen, 2022). Consequently, the research indicates the need for a fast and secure method for identity proofing supporting the application process. The current manual process has proven to be out of date and insufficient to the increasing demands of

contemporary immigration. An automated solution, supervised by a human and monitored by technical means is needed to solve the problems research has specified.

3.9 Knowledge basis

The technology SEK utilises is not new nor is it unbeknown to the public. In Finland automated passport control also referred to as eGates, have been in use since 2008 at various border crossing points nationwide. Equally internationally most airports, seaports and land border crossings are equipped with eGates. The SEK bares resemblance to the eGates in many aspects. Both are security driven solution which require high levels of assurance of the individual's identity. Both utilise both biographical and biometrical data to ensure the presented identity is authenticated automatically without any input beside the passport from the customer or in this case traveller. Consequently, the phenomenon of study is the behaviour of customers when a known application is transported out of its natural habitation, the airport's border crossing to the Immigration Service's customer service centre. Are the customers of Immigration also able to use a SEK and more importantly are they willing to accept and support its use?

It is evident that a significant change is required to ensure success, but it is necessary to prepare for future developments and possibilities. The systemic change the successful implementation of SEK kiosks requires is significant and fundamental. Yet, through thorough examination and analysis of test results it is likely that such endeavour may very well succeed, if nudged in the right direction.

3.10 Nudging a transformation and change management

It is quite evident that in contemporary society an organisation providing a service to customers must become technologically advanced to survive and thrive. Digital transformation is omnipresent, and its effects cannot be avoided despite the nature of services provided. The transformational change is steadily accelerating and business not able to adapt will perish. For example, video rental stores and to a large extent movie theatres have disappeared when the streaming media services emerged. Taxi companies struggle to with ridesharing services and even hotels with house sharing services. However, many organisations who have not been able to modernise their technical infrastructure in time face a significant technological debt, as they try desperately to migrate from burdensome legacy systems.

People are terrible in making decisions and organisations consist of people (Bazerman and Moore 2013). According to Bazerman and Moore human-beings easily succumb to diverse frailties such as biases, overconfidence, bounded awareness, framing and the reversal of

preferences, motivational and emotional influences on decision making, escalation of commitment, fairness and ethics in decision making, common investment mistakes, making rational decision in negotiations and negotiator cognition. However, knowing these traits, fallacies and heuristics play a key role in human behaviour as they can be negated or avoided all together. Knowing the weaknesses of human behaviour in transformational change allows the application of strategies to ensure the desired model of behaviour and decision-making is prominent improving the chances of success (Weiner, Mizumori and Weiner 2012).

Transformation theory as put forth by Jack Mezirov in 1978 (Ahteenmäki-Pelkonen, 1993) refers to the acknowledgement of the frailties of mankind and how individuals come to see their fallacies, and open to new perspectives. In terms of the organisation transformational change can be defined as essentially the result of a planned strategy of change, which combine cultural, incremental and organisational change (Mossop 2013).

Despite the mitigating actions to negate human fallacy, transformational change requires a leap of faith or even several leaps. The transformational change this particular thesis refers to requires a systemic change in a large governmental agency, yet the true change lays within its customers. To become a sustainable model of identification the customers must accept the new model of service design. If accepted, it may well be a new standard in customer service has been laid. Hacker points out (Hacker 2012), standardisation is all about narrowing variations until a uniform format, a standard has been established. Incremental improvement is a constantly improving curve (median of a curve) where progress is steadily achieved. Transformation on the other hand is a series of sharp changes in progress, a diagram in the shape of stairs where the vertical lines are the leaps of change and the horizontal lines depict a status quo.

Leading transformational change in a large organisation requires large-scale mobilisation of employees, provocation of thoughts and inspiration ambitious aspirations enabling fundamental change. The change should also include a change in mindsets as well as societal cultures to ensure longevity and to reach the set goals. One has to “unfreeze past behaviours” (Bazerman and Moore 2013:129) in order to become open to alternatives. In order to successfully promote change the afore mentioned frailties of human cognition need to be avoided. Strategies which support the desired outcome in decision-making should be applied. This implies nudging policies and choice architecture all-through a large-scale organisation. As nudges are defined as easily avoidable (Thaler 2018) the actual freedom of choice would remain its autonomy. It could even be argued that the ultimate decision made despite nudging and choice architecture is the outcome of a democratic process. However, the mechanistic evidence would indicate psychological mechanisms describing the cognitive processes that led to the decision.

Nevertheless, leading transformational change is essentially a change of perception of leadership. Rather than the classical authoritarian leadership, modern leaders are instrumental facilitators of change (Mossop 2013).

The time of old-school leadership needs to come to an end if sustainable transformational change is to be achieved. A top to bottom model of change is arguably not comprehensive and seldom other than a fixation of an authoritarian leader or a dictator. Both models are not the source of inspiration and growth, rather than oppression of freedom. To achieve transformational change modern leadership needs to become a model of inspiration and the nurture of company assets to stimulate growth, evolution, and development. It is a process of professional development in leadership model which can even be taught through coaching (Allison-Napolitano 2013, Hacker 2012). Fundamental change requires a change of mindset of the masses, the people. However, to reach large-scale change of perception might involve even a change in working culture in a company or agency. The more the attitude of the people has changed, the easier the transformational change become and the more fundamental and profound the actual change is (Bazerman and Moore 2013).

To put it in the form of a metaphor, transformational change leaders have become the proverbial gardeners planting the seeds of change management and tending to the seedlings until they have become grass, beautiful flowers or even tall trees. Leadership is not a competition, nor a Freudian ego-trip (Barford, Geerardyn & van de Vijver 2002). It is not about authoritarianism, personal power or achieving personal goals. It is an unselfish model of leadership, tending and nudging the seeds to grow in the correct direction to flourish (Sinek 2023).

3.11 Service design or legal design

The customer of today in the digital world where connectivity is omnipresent is more aware than ever of the services available and knows to demand the highest quality of service (Koivisto, M., Säynäjäkangas & Forsberg 2019). The customer is also more powerful than ever before. A review by one single individual may have great ramifications on a business (Stickdorn et al. 2018). A single customer can also springboard an unknown business to world fame. Compared to earlier days when the businesses were in full control of their public image and service quality. Today the customer may have a severe impact on almost any business positively or negatively and the importance of the customer experience should never be underestimated (Koivisto et al. 2019).

Stickdorn (et al. 2018) present a picturesque example, “United breaks guitars” by Dave Carroll (DaveCarrollMusic. 2007). Where one person showed an airline the might of social media and the need of service design. The musician Dave Carroll’s guitar was damaged during a domestic flight in U.S.A and despite lodging a complaint Dave Carroll received no compensation for the apparent failure to comply by the customer service of United Airlines. Dave Carroll proceeded to make 3 music videos on social media (YouTube.com) pointing out the airline’s shortcomings through music videos. The videos went viral and the American company United Airlines ultimately suffered a 10 % drop in market capitalization and an estimated loss of 180 million dollars. This example highlights an easily overlooked factor by businesses, to treat all customers equally. A tenet repeated many times in the Universal Declaration for Human Rights (United Nations Security Council Resolution, 1948), we are and should be treated equally, despite the circumstances.

Service design is one step further. It is not so different from legal design, which rather it is a logical continuance of service design. It answers the question of how to make law into a service with the focus on the customer. That is why we can see service design as a process, a mind-set which aim to solve the right problem to create value for the customer (Tikkanen 2017). In comparison to legal design service design is not a new concept. It is rather the combination of traditional methods with a modern solution (Tuulaniemi 2011). Service design starts with the customer’s needs (Koivisto, et al. 2019). It designs an approach which is constantly evolving. If a flaw or an opportunity for improvement is identified the service design may be changed, updated, or improved accordingly. A very powerful aspect of service design is its focus first and foremost on the customer; thus, it tends to break the traditional silos within businesses where communication becomes an obstacle. However, since service design follows the customer’s journey it does not conform into or recognize barriers created by the business internal processes or the need for legal design. Service design, however, supports cross-functional teams from different processes to co-operate further removing the silo effect. It’s all about customer experience, innovation, and collaboration. It knows no boundaries and can be implemented in most environments, such as an airport, the IKEA catalogue (Morelli, Götzen & Simeone 2021) or even a library (Virrankoski 2013). Consequently, service design and consequent legal design may very well be the solution for many businesses and governments who wish to improve their service capabilities and consequent worth. In comparison, if justice cannot be served nor accessed by society it has failed its very purpose (Linna 2019).

The customers expect business and governments to provide a sufficient amount of service design and adapt to the ever-changing digital landscape (Toivonen 2021). People are less interested in the core offering of a business than the layers of experience surrounding it

(Stickdorn et al. 2018). Consequently, businesses have adapted and according to a study conducted by Watermark Consulting in U.S.A. businesses which invested in the long-term research and development of service design added up to 80 % profit in the stock market compared to businesses who did not invest in service design (Koivisto et al. 2019).

Legal design suffers from not having an established definition and that it is not based on an overarching theory (Toivonen 2021). It is a form of communication for a government to thrive it must be flexible and adaptive. Today more than ever in the uncertain times in the aftermath of the pandemic. Markets have shown they can change drastically and extremely fast. Prior the pandemic predictions by businesses and governments were very different as to how it actually played out. Many businesses have fallen due to the pandemic, industries are suffering immensely, and governments forced to restrict people's daily lives to ensure public health. However, the pandemic has brought many opportunities in common and in most unexpected areas. The astronomical need of face masks and hand disinfectant caught most government by surprise. The businesses who could foresee this coming, even if it was on short notice boomed. Airlines were forced to rethink their customer journey from the airport to the airplane. Queueing amongst a large amount of people, face-to-face customer service and the frequent touching of surfaces were no longer viable options. Partially it became a question of service design, however, arguably before any model of implementation the solution is to be found in legal design. Service design is useless unless it has a legal framework to operate in, and in the heat of a pandemic there was none.

In this thesis the technical solution was already available, the use of biometrics, virtualisation of travel documents, optical rather than touch-based fingerprint scanners. However, there was little to none legal framework to support this. There was no service design to be implemented due to the lack of legal framework.

In fact, there were separate legal acts, standards in progress and new innovations, but there had not been any considerations of legal design to bring these together. Suddenly, amidst the pandemic there was. It led industries (Thales 2021), governments (Ministry of foreign affairs 2021), European Union (EU TFG 2021) and large international organisations (ICAO 2020) to invest in new technology, finalizing quickly new standards for their application and drafting new laws. All to support one form of travel - seamless travel using biometric identifiers and contactless technology as enablers. On the other hand, these seamless traveller initiatives as they are referred to are customer centric, service design at its core with the end-product, a flight, as a secondary factor. The customer's needs have de facto to become the core of the

design. It is no longer sufficient to invent a new product and launch it. Despite innovation in product design, it risks falling short if no service design is applied (Koivisto et al. 2019).

In Finland service design has thankfully been adopted with low effort due to our non-hierarchical society and open minds. Service design derives originally from the 90's and the founding of the Service design School in Cologne, Germany in 1994 (Tikkanen 2017). Today it is growing rapidly in Finland (Tuulaniemi 2011). Koivisto (et al. 2019) even argue that service design has become a national phenomenon, a trend. The demand of service design has grown as businesses and even the government have identified the need to apply improved customer experience in order to compete nationally and internationally. It has been recognized that even governmental administrative services are in dire need of revamp, customer centricity and consequently legal and service design. This approach applied by the government in its agencies is new, and not widespread. Some ministries find it easier to implement and utilise service design and some find it difficult. Arguably the different functions, policies and legal acts affect each ministry differently. Nevertheless, even in hardened bureaucratic agencies service designers have gotten their occasional chance to prove their capabilities. And where they have gotten a fair chance, it seems they have succeeded to convince these stalwarts of conservative disposition.

An aspect of great value for service design is its capability of designing even the invisible products visible to the customer (Tuulaniemi 2011). This method of bringing life into the purely abstract, intangible processes or even a string of technical procedures is customer centric at its best. Service design brings to life and into vision what the customer could not see with his or her eyes. Visualisation and illustration even have the capability of improving the actual product. Furthermore, service design support non-conventional methods and out-of-the-box thinking. Despite its analytical and innovative core, it strives on a wide array of less common methods such as "brainwriting" and "octopus clustering" (Thisisservicedesigndoing.com 2022). When analysed brainwriting refers to a method of generating many ideas quickly promoting diversity and the less assertive participants to contribute. Octopus clustering on the other hand refers a quick group method to cluster ideas into one shape in preparation to take a decision. Again, it promotes even the less assertive to participate in the group's work.

In conclusion service design has arguably become a force of nature even though it generally is not measured according to any quantitative parameters (Morelli, et al. 2021). Perhaps one day these parameters will be defined and standardized for wider application. On the other hand, not all processes and parameters need to be measured. Service design has already proven that the collaboration between design and professionals from diverse disciplines can create great

things. And the service designer's capabilities should be complemented with other professional skills which are essential for the consolidation of the innovation process (Morelli et al. 2021). The prevalence of both legal design and service design are arguably quite evident. They both turn the processes the other way around putting the end-user, the customer in the centre not vice versa as it has traditionally been. The law has never before been meant to be a service, and especially not a service for the people. The changes brought and developments made speak for themselves. Legal design and service design are here to stay.

4 Research and development

In the ever-evolving landscape of technology and innovation, research and development stand as the cornerstone for progress and growth across various sectors. The pursuit of knowledge and the quest for advancements have fueled the engines of economic development, scientific breakthroughs, and societal well-being. This chapter provides an overview of the significance of research and development, its historical context, and its role in shaping the present and future.

By definition Research and Development, commonly abbreviated as R&D, encapsulates a systematic and investigative process aimed at creating new knowledge, products, or processes. It involves a combination of scientific, technological, and managerial efforts to enhance existing capabilities or pioneer novel solutions. R&D activities span diverse domains, including but not limited to science, engineering, medicine, and business.

The historical roots of R&D can be traced back to ancient times, where philosophers and scholars engaged in systematic inquiry. However, the formalisation of R&D as a distinct discipline gained momentum during the Industrial Revolution. The 20th century witnessed unprecedented strides in R&D, particularly in response to global challenges like World Wars and the subsequent Cold War, leading to the establishment of dedicated research institutions and frameworks.

The importance of R&D cannot be overstated in the contemporary world. It serves as the engine of innovation, driving economic competitiveness and fostering sustainable development. R&D activities contribute not only to technological advancements but also to the understanding of fundamental principles in various fields. Societal progress, improved quality of life, and the resolution of complex challenges are among the multifaceted outcomes of robust R&D endeavors.

The objectives of R&D are diverse and dynamic. They include the creation of new knowledge, the development of cutting-edge technologies, the improvement of existing products and processes, and the exploration of uncharted frontiers. Additionally, R&D plays a pivotal role in addressing societal needs, fostering creativity, and maintaining a competitive edge in the global arena.

This thesis is structured to delve into the multifaceted dimensions of R&D, exploring its methodologies, challenges, and impact on various sectors engaged in systemic change. Each subsequent chapter will focus on specific aspects, providing a comprehensive understanding of the dynamic landscape of research and development.

This research contributes to the existing body of knowledge by offering insights into contemporary R&D practices, methodologies, and their implications. By understanding the intricacies of R&D, stakeholders can make informed decisions that foster innovation, economic growth, and societal well-being.

In conclusion, this introductory chapter has provided a brief overview of Research and Development, emphasizing its historical evolution, significance, and the objectives that underpin its endeavors. The subsequent chapters will delve deeper into specific facets of R&D in the field of biometrics, providing a holistic understanding of this dynamic and pivotal field.

4.1 Research methodology

Research is a systematic and organised process that aims to expand knowledge, answer questions, and contribute to the advancement of various fields. It involves a careful investigation, analysis, and interpretation of data to generate new insights and information. In a rapidly changing world, where information is more than abundant and diverse, research plays a pivotal role in providing evidence-based solutions to complex problems (Charmaz and Belgrave 2012, Gilbert 2013).

The process of research is not confined to any specific discipline; it encompasses a wide range of fields such as science, technology, social sciences, humanities, and more. The methodologies employed in research may vary, but they all share the common goal of uncovering new truths or refining existing knowledge. This chapter introduces the fundamental concepts of research methodology, its significance, and the key components that form the foundation of any research endeavour (Gilbert 2013, Cresswell 2014).

The primary objectives of this chapter are as follows:

1. To define and explain research methodology.
2. To highlight the significance of research in various disciplines.
3. To provide an overview of the key components of research methodology.

4.2 Defining Research Methodology

Research methodology refers to the systematic approach and set of principles used to conduct a research study. It encompasses the entire process, from the formulation of research questions or hypotheses to data collection, analysis, interpretation, and conclusion. The choice of research methodology depends on the nature of the research question, the available resources, and the goals of the study (Neuman 2013, Sekaran and Bougie 2016).

4.3 Significance of Research

Research holds immense significance across diverse fields:

1. **Advancement of Knowledge:** Research contributes to the expansion of knowledge by exploring uncharted territories and generating new insights.
2. **Problem Solving:** Research provides evidence-based solutions to real-world problems, leading to improved processes, policies, and technologies.
3. **Innovation:** Scientific research drives technological and medical innovations that enhance the quality of human life.
4. **Decision Making:** Research-based information aids policymakers, businesses, and individuals in making informed decisions.

4.4 Key Components of Research Methodology

The research process typically involves the following key components:

1. **Research Question:** The central question that the research aims to answer. It guides the entire research process.
2. **Literature Review:** A comprehensive analysis of existing research and literature related to the research topic. It provides context and identifies gaps in knowledge.
3. **Methodology:** The approach and techniques used to gather and analyse data. This includes qualitative, quantitative, or mixed-method approaches.
4. **Data Collection:** The process of gathering relevant information or data from various sources, such as surveys, experiments, interviews, observations, and more.
5. **Data Analysis:** The systematic examination and interpretation of collected data using appropriate statistical or qualitative methods.

6. **Results and Findings:** Presentation of the outcomes of data analysis, often accompanied by tables, figures, and textual descriptions.
7. **Conclusion:** A summary of the findings and their implications, as well as suggestions for further research.

These components define the research methodology, its significance, and the core components that form the foundation of any research study. Research is a dynamic and evolving process that drives progress across numerous fields, and understanding its fundamental principles is essential for conducting meaningful and impactful studies. Research of customer experience, which is the main focus in this thesis may have a direct societal impact (Cam & Irmak 2014).

Contemporary customers are demanding and expect high quality, intuitive and seamless customer experience at every touchpoint. Consequently, trust is paramount. If an organisation cannot protect the security and privacy of its customers, it risks losing customers. In case of a data breach not only would the organisation lose its existing customers, but also potential customer who would not be affected by the data breach.

4.5 Research Objectives

The primary objectives of this research design are as follows:

1. To evaluate the technology's performance during the test periods.
2. To analyse user experiences and customer reviews related to the technology.
3. To assess the reliability and technical performance of the technology.
4. Through re-evaluation to evaluate the technology's performance during the second test period.

4.6 Research Approach

During specified two test periods, the technology under study (SEK) was deployed and made available for use by the pre-selected target audience. These periods served as an opportunity to collect real-time data on the technology's functionality, usage patterns, and any potential issues encountered by users.

A review and analysis of how the technology was used during the test period was conducted. This involved tracking the frequency and duration of usage, identifying the features utilized most frequently, and observing any user behaviours that indicate satisfaction or frustration.

Customer reviews and feedback were collected from users who participated in either test period. This information was gathered through surveys, questionnaires, and open-ended interviews. The reviews provided insights into users' perceptions, opinions, and overall satisfaction with the technology.

The technical assessment focused on two key aspects: the technology's performance and its reliability. After all, biometric technology requires rigorous scrutiny.

A thorough evaluation of the technology's performance was conducted. This included assessing factors such as speed, efficiency, accuracy, and any technical glitches encountered during the test period.

The reliability of the technology was assessed based on its consistency and stability. This assessment considered factors such as downtime, error rates, and the technology's ability to consistently deliver the intended outcomes.

The research methodology employed a mixed-methods approach, combining qualitative and quantitative data collection and analysis. This approach enabled a comprehensive understanding of both user experiences and technical performance.

Ultimately the most important factor of the research was the customer experience. Technical developments of biometric solutions are identified, however, as this thesis points out the customer segment using the SEK, biometric self-enrolment kiosks are new. Thus, the customer journey shall dictate the development of biometric technology (Denscombe 2014, Cresswell 2014). However, as research will reveal an initially overlooked aspect was the measurement of the attitudes of the officials involved in the SEK test periods. Their bias, as described in an earlier chapter on bias, placed additional challenges on the systemic change SEK is to bring along.

4.7 Data Collection Methods

Usage data was collected through the SEK technology's built-in tracking mechanisms. This data included metrics such as the time spent using the technology, and the specific features accessed, rate of success of verification and rate of success of enrolment.

Customer reviews were collected through online surveys and interviews conducted by immigration officials. Participants were asked to share their experiences, opinions, and suggestions related to the technology's usability and functionality. The customer review was

extended beyond the customers to include also immigration officials who tested the SEK in operation giving more detailed insight from the agency's point of view.

The technical assessment data was collected by monitoring the technology's performance in real-time during the test period. Any technical issues encountered was documented, along with the frequency and impact of these issues.

Quantitative data, such as usage metrics and technical performance indicators, was analysed using statistical methods. Qualitative data from customer reviews was subjected to thematic analysis to identify common patterns, sentiments, and opinions (Patton 2016, Rock 2012, Fielding and Thomas 2013).

As such, this chapter has outlined the research design and methodology for evaluating a technological innovation during its test period. The approach included reviewing usage, analysing customer reviews, and conducting a technical assessment to comprehensively evaluate the technology's performance and reliability.

4.8 Research limitations

Several limitations were identified during the study and test period:

Sample Size: The number of participants during the test period was limited, which may affect the generalizability of the findings. In total 72 customer's (P=31+41) participated in the two test period together with an smaller undefined amount of immigration officials.

Time Constraint: The test periods were limited to a short time span, potentially impacting the depth of data collection and analysis.

The development method followed an iterative approach, involving two cycles of testing, refining, and deployment. The application of this method in the thesis encompassed tracking the technology's development progress and its impact on user experience and performance (Cresswell 2014, Guest, MacQueen and Namey 2012).

A purposive sampling method was utilized to select participants for the test period. Participants were chosen based on their willingness to engage with the technology and provide valuable feedback.

Data collected during the test period were stored on secure servers with restricted access. Only authorised personnel had permission to access the data. A data management plan was

established, outlining data retention and deletion procedures to ensure compliance with privacy regulations (Bryman 2015).

Quantitative data, such as usage metrics and technical performance indicators, were analysed using statistical methods. Qualitative data from customer reviews were subjected to thematic analysis to extract meaningful insights, trends, and attitudes towards the tested technology (Procter 2013).

Ethical considerations included obtaining informed consent from participants, ensuring data privacy, and transparently communicating the purpose of data collection. Steps were taken to minimise any potential harm to participants and to maintain their anonymity.

Finally, in the process of testing a new technology for customer use such as the SEK, it is important to acknowledge certain limitations inherent to the study. Drawing inspiration from sociological perspectives like Emile Durkheim's concept of anomie and Robert K. Merton's notion of anomalies, potential limitations arise from the disruption of established norms and the possibility of unforeseen challenges. Just as Durkheim's anomie refers to the breakdown of societal norms leading to feelings of disconnection and confusion, the introduction of new technology can disrupt users' accustomed routines and create a sense of uncertainty. Moreover, Merton's anomalies, which involve contradictions between societal goals and available means, can be analogously applied to the incongruence that may emerge between the intended benefits of the technology and its actual performance. These theoretical perspectives emphasize that technological innovation can introduce anomalous situations, challenging user expectations and potentially revealing unforeseen issues that need to be carefully considered during the testing process (Bernburg 2002, Durkheim 2013, Cam and Irmak 2014). Crime is a societal fact and attempts to spoof or cheat the SEK are equally factual, yet all attack vectors cannot be reliably identified at the point of research (King and Wincup 2008).

5 Testing the self-service biometric kiosk - SEK

A self-service biometric kiosk prototype was made available for Migri to test in two separate periods of time using an operational environment and with actual customers. This prototype, first of its kind was designed to fulfil the technical requirements set in order to receive empirical test data. For the test a service point was selected, and the SEK installed in a controlled environment with CCTV cameras monitoring and a human operator present at all times when the SEK was in use. Customers were pre-selected in order to assure with Migri's licence administration met their requirements. Only volunteers willing to use the SEK were appointed a time when to use the kiosk. It was acknowledged that the kiosk was indeed a prototype and not a final product.

Limitations were recorded in advance and during the test period. All customers using the SEK were interviewed afterwards for maximal input of the customer journey in their experience. Equally all officials and high-level visitors testing the SEK were interviewed adding to the test result insights from immigration authorities.

The SEK's performance was recorded in detail and all performance data was collected and analysed. The process of using a SEK was as follows:

- 1) Insertion of a valid and accepted travel document to the document reader.
- 2) Authentication of the document and its RFID chip.
- 3) The extraction of the holder's biographical information, facial image and fingerprints for comparison.
- 4) Facial image comparison of the document image to the person presenting the document.
- 5) Fingerprint comparison of the document index fingers to the person presenting the document.
- 6) If both automated biometric comparisons were successful a reliable link between the holder and the document was established. In order terms a successful multi-modal (facial image and fingerprint comparison) biometric authentication was completed
- 7) Upon a successful authentication the customer was enabled to proceed with submitting new biometric data for their application to Migri. This may have included enrolment of fingerprints, facial image and signature.
- 8) With support of the human operator, the Migri official present at all times the submitted data could be verified and proceed to payment.
- 9) A payment transaction for the services was made and upon successfully completing all listed steps the customer had concluded their transaction with Migri. If further services were needed the customer was directed to a desk officer.

10) All biometric data used in the authentication was deleted.

The primary biometric identifier used was the facial image and secondary fingerprint. These were used in sequence for the authentication process, to ensure the customer presenting a travel document to the SEK was indeed the rightful owner. Upon successful verification a link was established between the travel document and its holder allowing further use of the SEK. If the authentication process failed, no further actions were possible to conduct.

Upon a successful authentication transaction, the customer was enabled to continue with the enrolment of biometric data, facial image, fingerprints and signature. Finally, the customer was able to pay for the service using a payment option on the SEK. If all the above steps were successfully completed the SEK had performed as designed.

All data processed by the SEK was recorded and performance analysed, especially the biometric data processing. Only performance metrics were recorded and no biometric data was stored, except the intentionally enrolled biometric data. The metrics measured included the time it took to authenticate and enrol, the success rate of authentication and enrolment. Furthermore, biometric data was meticulously measured and match rates closely examined. A crucial aspect was the accuracy of the facial comparison algorithms and fingerprint comparison algorithms. The technical requirements for a successful comparison were extremely high in order to achieve reliability of the SEK in self-service use (Tistarelli & Champod 2017). In the end the SEK's performance was under scrutiny to ensure it filled the technical requirements and consequent legislation and regulation set for the processing of personal data including biometric data.

The evaluation of test results for the SEK in operational customer use provided valuable insights into the real-world performance and effectiveness of the innovation. This phase of the research served as a critical juncture to assess the technology's alignment with user needs, its impact on customer experience, and its overall viability in practical scenarios (Davis 1989, Rogers 2003). By examining the outcomes of the technology's deployment, researchers gained a deeper understanding of its strengths, limitations, and potential areas for improvement. It was well known the SEK was a prototype, and results both positive and negative were well received and presented invaluable insights for the project to proceed. The next chapter delves into the analysis of test results, drawing on established research methodologies and frameworks to interpret the findings in the context of customer use (Venkatesh and Davies 2000). Both customers' and immigration officials' feedback were analysed and transcribed.

5.1 Results and feedback, the complete analysis

The reception of the concept of incorporating self-service kiosks into the service repertoire of the Finnish Immigration Service was predominantly positive among customers and officials. Feedback from customers has highlighted a prevailing sentiment that automation is an integral facet of modern life, seamlessly integrated into various contexts, thus making its inclusion in processes such as residence permit matters not only logical but also beneficial. However, particularly amongst officials a strong bias lingered and highlighted distrust in technology and focus on insignificant technical and processual details, which do not seem to be an issue when manually processing licence administration. In the spirit of Durkheim and Merton an anomaly was identified. The SEK's ultimate goal is to support the customers, but equally the immigration officials who currently conduct the exact identical procedure manually. The anomaly was that the officials presented dis-belief that the SEK would work or actually help their work. A strong distrust and vocal slandering of the SEK continued to prevail despite its evident benefits for the agency and its officials. This anomaly may well be part of the systemic change the SEK has initiated and could become a subject for research on its own.

Nevertheless, the Introduction of self-service kiosks is perceived to possess considerable potential, as it is anticipated to expedite transactions and enhance convenience for both patrons and administrative personnel. Among the pool of customers subjected to interviews, a mere 6 % expressed a preference for human interaction over engaging with a machine. This inclination towards mechanised interaction is attributed to the paramount importance of efficiency and swiftness in task execution. The feedback underscores that the self-service kiosk's utilisation is particularly apt for individuals managing their applications independently. However, it also emerges that the device's efficacy diminishes when individuals are accompanied by children, thereby necessitating assistance from a staff member in such cases.

Customers expressed a compelling need for reassurance regarding their proficiency in utilising the device accurately. Anticipating this requirement, customers advocate for pre-emptive information on device operation, such as instructional animations accessible through the Migri.fi website or displayed on a rotating screen in service point lobbies. A pivotal criterion is the device's capacity to encompass the entirety of the transaction process, incentivising customers to opt for the device over interacting with a service clerk, a human operator present at the SEK.

For instance, functionalities like card renewal and payment could be seamlessly integrated into the device interface. Enhancing user-friendliness, customers stress the importance of a keyboard feature allowing data editing, particularly for modifying or updating personal

information. Broadening accessibility, a more expansive range of language options is deemed imperative. When confronted with concurrent tasks, customers seek clarity regarding the feasibility of managing both tasks through the device or, alternatively, which task should be prioritised for device usage. Although the prospect of capturing photographs through the device garners positivity, the image quality remains a concern. Customer feedback accentuated an inclination towards visual and animated instructions over textual and auditory guidance, advocating for a more illustrative approach in providing operational guidance.

The Intense luminosity emitted by the device caused disruption among customers, raising concerns of potential harm, particularly for individuals with epilepsy. In response, a cautionary advisory about the luminous display is deemed imperative.

Customers expressed the desire for a concluding preview of the transaction outcome, possibly accompanied by a glimpse of the forthcoming residence permit card. The ability to generate a transaction receipt is regarded as beneficial. Furthermore, customers recommended a feature that elucidates the subsequent steps and provides information on card collection logistics, potentially through email notifications.

Addressing the device's physical placement, customer expectations converged around ensuring privacy. The proposition of a designated space—be it an enclosed room, screen partition, or individual booth—is advocated. To accommodate multi-device settings, suggestions included the provision of screen protectors and headphones. During device placement, due consideration must be given to an appropriate background for capturing photos. Customers expressed the need for devices to be available at various locations, extending beyond Migri's service points, such as within police premises.

The potential for spontaneous, walk-in utilisation is acknowledged, while queue numbers and appointment scheduling were identified as viable alternatives. Ensuring a contingency plan, customers emphasized the importance of staff accessibility for troubleshooting. To facilitate prompt assistance, a call button feature is proposed, enabling users to summon an official for guidance.

Customer apprehensions encompassed various scenarios regarding device usage. There was a prevailing concern that operational glitches might arise during device interaction, or uncertainties may surface regarding adept device usage or language comprehension.

Inquiries arose about contingency plans if the device malfunctions at the moment of intended use. Furthermore, doubts lingered on verifying transaction completeness and avoiding the need for a subsequent visit to the service point.

Customers were inquisitive about potential repercussions in the event of an erroneous appointment booking, or if the desired photograph fails to meet standards, questioning its appearance on the card. A decisive factor, customers emphasized, would be clarity within the Enter Finland platform concerning matters amenable to self-service machine processing. A notable omission was the absence of an “expired card” option in the menu, a valuable addition to the array of selections.

In general, enthusiasm resonated with the prospect of a self-service kiosk. The sentiment prevailed that harnessing a self-service machine for handling services could free officials from routine counter tasks, empowering them to focus on decision-making, while expediting the processing of a larger volume of applications. A prevailing belief among many customers was that opting for a self-service kiosk would infuse a sense of ease and pleasantness into their dealings, thereby augmenting the breadth of service options accessible to them.

Foremost among the advantages discerned from utilising the machine was the absence of the need for pre-scheduled appointments. The kiosk’s availability for use, contingent upon customer convenience, through queue-based access resonated as a practical advantage. The kiosk could strategically cater to customers with specific needs such as biometric submissions or payment of processing fees. The standardisation of machine identification was an attribute commended for its consistency.

A coveted scenario envisioned especially by immigration officials was the integration of multiple devices to optimize customer flows. The feasibility of extending similar services, such as passport renewals, found favour. With comprehensive knowledge of the service events amenable to device utilisation, the prospect of mutual benefits for customers and the agency became a promising prospect. Yet, in contradiction a strong disbelief or opposition of the SEK’s performance continued to linger amongst immigration officials. This strong both pro- and anti-attitude towards the SEK was found to be intriguing, an anomaly brought by the systemic change itself.

5.2 Concerns, there always are

In more details, among immigration officials’ apprehensions arose concerning the self-service device’s capacity to accurately identify individuals, its efficacy in detecting potential misuse,

and susceptibility to manipulation. The imperative investigation of potential vectors for misuse was simply underscored. A critical aspect involves testing the SEK device's vulnerability to subversion. Pertinent concerns also revolve around customers' competence in utilising the machine, particularly given the prevalence of limited IT and language proficiencies among many customers. In cases where biometric data acquisition encountered difficulties, customers resort to obtaining a queue number for interaction with a service clerk / a human operator, an experience that could potentially elicit dissatisfaction. Furthermore, inquiries emerge regarding the custodianship and upkeep of the equipment, querying whether responsibility rests with the service point or other entities.

There exists a potential risk that customers, despite engaging with the SEK, harbour a residual need for verification from a desk officer, seeking reassurance regarding the accuracy of their interactions or merely human interaction. The incorporation of a payment terminal prompts considerations about the synchronisation of correct pricing onto the device. Pertinent queries revolve around whether customers manually select the application type from the device menu, influencing the price calculation, or whether the pricing information is sourced directly from Migri's database upon input of the customer number. The exploration of alternative options remains and are explored even if they are not part of this thesis' scope.

5.3 Room for improvement, there always is

The concept of a self-service device prompted some officials to ponder its actual functionality and benefits, particularly if it merely focused on customer identification. However, as it became evident that the trial phase did not encompass the initiation of applications, this clarification facilitated a better understanding of the overall process. After all, as stated earlier a prototype of a SEK was tested, not the actual nor final product.

Despite expectations that the device would integrate with Migri's database and webservice, disappointment emerged regarding its current functionalities and capabilities. The device's incompleteness, nonetheless, accentuated the critical importance of the testing phases. The vision of a truly beneficial and streamlined self-service kiosk remained distant for officials. Enhancements are necessary to guide customers step by step through various scenarios and provide prompt corrective advice in instances of biometric failures. Notably, bug-related issues were identified in customer identification, a cornerstone function that demands meticulous attention to eliminate all faulty aspects, preventing any erroneous identity verifications. The device's core purpose demands reliable, smooth, and swift customer identification, including how the device responds to expired identity documents or specific document notations.

Looking forward, it's imperative for the device to accommodate diverse demographics. This requires offering a range of languages, employing clear and concise textual instructions, providing explicit visual guides, and incorporating avenues for human assistance. An advantageous feature could entail retrieving contact information filled out by applicants and verifying its accuracy. Challenges arise in cases where incorrect application types are selected, as the machine might not discern such errors as efficiently as a human clerk, potentially necessitating visits due to missing biometrics.

Future refinements should encompass improved camera quality, comprehensive instructions for image capture, and illustrative samples of correctly/incorrectly captured photos. The alignment of target groups and suitable service requirements for the self-service model is indispensable. Equally essential is devising effective means to inform customers about the availability and usage of the self-service machine, including scenarios where identity verification is feasible without a biometric passport.

Recognising that many Migri customers lack technical proficiency, it's prudent to consider that utilizing online and even paper applications can be daunting due to language and technical challenges. Therefore, a prerequisite for device use should involve the completion of an electronic application. Overall, the device should advance considerably to achieve true autonomy, thereby saving officials' time. In terms of usability, the inclusion of a keyboard is crucial, enabling customers to make corrections to their personal information, such as address changes. Further, concerns were raised about the size of the fingerprint reader screen and the height of the signature tray, both of which posed inconveniences for specific users.

5.4 How can businesses convince customers to use new biometric technology?

To begin with, it is crucial to understand the customer's pain points and offer solutions that address their needs. Biometric technology can offer greater convenience by eliminating the need to remember passwords or carry identification cards, which can be lost or stolen. This can save customers time and hassle in their day-to-day lives. Secondly, businesses need to educate customers on the benefits of biometric technology and reassure them about its safety and security. Customers may have concerns about the collection and storage of their biometric data, so businesses need to be transparent about their data handling policies and adhere to the highest security standards. Thirdly, businesses should offer a seamless integration of biometric technology into their existing customer experience. This means making the biometric authentication process easy to use and understand, with clear instructions and feedback. Businesses should also provide alternative authentication methods for customers who may not be comfortable with biometric technology. Finally, businesses need to keep up with the latest

trends and developments in biometric technology to stay competitive and offer the best possible customer experience. This includes investing in research and development to improve the accuracy and efficiency of biometric authentication, as well as staying up to date with changing regulatory requirements.

In conclusion, the customer journey is critical to the success of any business, and biometric technology can enhance the customer experience by providing greater security and convenience. However, businesses need to convince customers to trust and adopt these technologies by addressing their pain points, educating them on the benefits, reassuring them about safety and security, offering seamless integration, and staying up to date with the latest trends and developments. By doing so, businesses can create a positive customer experience that leads to loyalty, retention, and advocacy.

6 Conclusions and reflection

Expectations were high in setting out testing the SEK despite the researchers being fully aware the product was a prototype and by no means a complete device. This aspect was frequently overlooked as the feedback indicated. Particularly immigration officials expected the monolith, the SEK to perform far beyond the scope of the specifically design test period and the capabilities of the prototype. The results were invaluable as the test was first of its kind, possibly in the whole world. Consequently, a slightly nervous atmosphere lingered among the researchers. However, the results were mainly positive and most importantly the aspect of testing a SEK was to see if the customer found the concept acceptable. It was the customers' insights which were the most valued input the researchers could have. The results of only 6 % of the test subjects would prefer the traditional human for licence administration service was received very well.

The technology of the SEK was as pointed out several times in this thesis, not the main focus. Technical glitches and performance will obviously be addressed, fixed and functions improved in accordance with the feedback received and the metrics recorded. Nevertheless, the technical performance of the SEK was satisfactory and provided rich data as to improvements of functionalities. The SEK prototype performed as designed with little to none concerns regarding privacy, data protection, information security and impeding legislation and regulations.

The feedback of customers and officials alike was predominantly positive. 94 % of customer test subjects preferred to use a SEK if made available. This success rate in customer experience proves that despite introducing a proverbial monolith to a new customer segment

did not end up as in Stanley Kubrick's movie. In fact, the results only added to the initial concept and technical requirements. The results gave invaluable insights and metrics in how to improve and refine the concept. With this data the SEK is set to become a successfully implemented technological innovation, which primary function is to support the customer journey and optimise the customer experience through service design and with biometric technology within its core. However, the critical attitude of the officials towards the SEK highlighted the need for a systemic change not only among the users of the SEK, the customers. But also, and equally importantly amongst the officials operating and supervising the SEK. If the officials fail to support the change it may very well have a negative impact on the customers using the SEK. The research identified several key factors in how to support the customers' systemic change, but it also encompassed the supervisors of the SEK and their crucial importance in the process of transformational change.

Consequently, the most valuable data collected and analysed from the research was two-folded. First, the customers are unfamiliar with the technology that a SEK represents and they need intuition and ease of use of the device. In addition, the human factor must not be overlooked and a human operator must both monitor the process and guide customers when needed. In the research the high interest to use a SEK amongst customers has been highlighted. However, to actually comply with this service design obligation requires immigration officials to effectively win the hearts of their customers. This may indeed be the real challenge as secondly; immigration officials presented a surprisingly high level of scepticism that the technology would actually work. During the test phases a small number of customers failed to execute the whole process at a SEK. Despite this inevitable failure percentage when testing a prototype, immigration officials mainly highlighted flaws and insignificant technical details. Many of the highlighted problems could be assessed to actually indicate issues in their current processes merely projecting them onto a SEK. This negative attitude or bias may very well be a part of the systemic change the SEK has already put into motion. It could be part of the psychological process involving change where denial and anger play a significant role.

This thesis has examined an innovative concept in how to enhance customer experience in a governmental agency with a reputation of rigidity and time-consuming processes. However, the ultimate take-away is that even a technological invention as the SEK may not thrive unless it wins the hearts of its users and its patrons. If the latter fails in the transformational change the ramifications may well topple the endeavour to convince the users, the customer, of the systemic change to use a SEK. It is thus a classical two-folded blade where both parties are required to be considered carefully, as both shall embark on their own voyage involving

systemic and transformational change. And if they meet in the proverbial middle success may be made.

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