Literature Review on Operational vs. Digital Backbone: Successfully Transforming IT Infrastructure

Seminar paper

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Abstract

The role of the IT infrastructure for a company's performance has become increasingly important in recent years. The reason for this is a growth in new digital opportunities, which leads to rapid market development and adaptation of customer needs. In order to stay in the market and gain a competitive advantage, incumbents must restructure and generally drive the digital transformation. The indispensable basis for this transformation is a new IT infrastructure that serves two main purposes. On one hand, a stable and reliable operational IT backbone must be established for efficient core processes. On the other hand, a digital IT backbone is also required to enable rapid innovation and adaptation without risk to the core IT. This paper establishes the superior framework from a management perspective that needs to be considered when transforming an IT infrastructure into these two separate backbones. It additionally explains to what extent a suitable combination of both systems brings further advantages.

Keywords: Operational Backbone, Digital Backbone, IT Infrastructure, Two-speed IT.

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1 Introduction

Today, customer needs as well as market environment change quickly. Moreover, digital technologies constantly introduce new features. Many incumbents struggle with adapting to this fast-changing environment and integrating new technologies (f. e. IoT technologies). One reason for this struggle are inefficient and badly performing IT systems that can't provide the basic foundation (Garcia Avendillo *et al.*, 2015). Obviously, in addition to the already outdated IT systems, the rise of digital opportunities increases the demands on the IT systems even more (Delmond *et al.*, 2017). Therefore, incumbents need to drastically transform their IT landscape in order to gain or defend sustainable competitive advantages (Ross *et al.*, 2016). Moreover, the adaptation of the IT infrastructure is the basis for further digital transformation within the company (Gampfer, 2018).

Overall the great challenge lies in integrating new technologies into the existing IT systems to enable a better customer experience in the end (Andersson *et al.*, 2012). In order to achieve this, the IT landscape has to transform in two ways (Furr and Shipolov, 2019). First the existing legacy systems have to be modernized and adjusted using new digital tools. This so-called operational backbone then provides efficient and at best automated core business processes. Thereby operational costs and non-value-adding work can be significantly reduced (Bossert *et al.*, 2014). Second, a flexible IT system is required to capture new opportunities and innovation in the digital age (Furr and Shipolov, 2019). This flexibility in a digital IT backbone increases a company's ability to react to market demands (Bhatt *et al.*, 2010).

Many papers in literature only focus on one of the two transformation processes: either the operational or the digital backbone. Some papers explain how to transform existing legacy systems into an efficient and reliable operational backbone. Conversely, other papers describe how to use new digital technologies in order to establish a digital backbone for rapid innovation. Only few papers focus on achieving both at the same time and even fewer analyse how to link the two types of IT infrastructure. Therefore, this paper aims to collect relevant literature and combine them with the focus on building both backbones simultaneously. Moreover, it includes aspects on linking the two different IT landscapes and their benefit. Considering this objective, the following question guided the research conducted for this paper:

> *What is the key framework when building an operational and a digital backbone and how can both be linked to successfully transform an enterprise?*

To answer this question, I begin with some background information and definitions of the operational and the digital backbone. Afterwards, I describe my research method and especially focus on the challenge of finding appropriate search terms. In the next section I present the results of my literature research. First, I review the three key principles for each backbone that are essential for a successful transformation. Second, I summarize why both backbones are being separated at all and what benefits can nevertheless occur when linking them with a suitable approach. Next, I discuss my findings and start by highlighting some differences between the authors. Then I continue with practical applications of the framework found in literature. Finally, I mention some areas for future research and clarify some limitation of this paper. In the end, the results of this literature review are summed up and put into the larger context of general digital transformation.

2 Background

As operational and digital backbones are terms introduced by Ross et al. (2016), I want to shortly define both and summarize the main characteristics. These definitions and the difference between both backbones are essential for the understanding of the following framework.

2.1 Definition of Operational Backbone

The term operational backbone was introduced by Ross et al. (2016) and includes all IT systems that are necessary for efficient business processes of the core operations. This typically includes Enterprise-Resource-Planning Systems or historically grown legacy systems as well as all other components that support the main processes for a company's value proposition. In general, it is a slow-changing environment that has stability, efficiency, high-quality, reliability and cost-reduction as its targets. Besides the technological capabilities, the operational backbone also includes business capabilities.

In addition to Ross et al. (2016), other authors refer to this operational backbone using other names but similar definitions. Winkler and Kettunen (2018) state that the operational backbone is the basic platform to ensure efficiency and reliability along with predictable business operations. Delmond et al. (2017) also describe the operational backbone as a stable system just like Nathe (2016), who defines it as historically grown, stable and reliable Business-IT. For Kaidalova et al. (2018) the operational backbone includes organizational and technological components that need to deliver high quality for stable and efficient as well as low-cost business operations.

As I mentioned earlier despite the use of different terms, all authors have a similar understanding of an operational backbone that enables greater operational excellence for the entire enterprise.

2.2 Definition of Digital Backbone

In contrast to the stable operational backbone, Ross et al. (2016) define the digital service backbone (or short just digital backbone) as all IT systems for rapid innovation. They ensure fast adaptation to changing market conditions. Like the operational backbone, a digital backbone does not only consist of technological capabilities but also business capabilities that are a basis for rapid innovation. The objective is to quickly transform ideas into valuable products or services.

Besides the original definition by Ross et al. (2016), several authors rephrased or supplemented this definition. Both Delmond et al (2017) and Kaidalova et al. (2018) agree that the digital backbone includes local small applications that quickly change and adapt. Nathe (2016) adds that the digital backbone is an individual IT landscape completely separated from the operational backbone.

3 Literature Review

The Literature Research started based on Ross et al. (2016), who first introduced the terms operational and digital service backbone. As the aim of this literature review was to find more about how to actually transform IT infrastructure into those two backbones, I started by searching exactly those two terms. Unfortunately, but not unexpectedly, these terms didn't generate many results as both terms aren't widely established. Consequently, the main challenge was to identify appropriate search terms. In addition, the review turned out to be an iterative process.

3.1 Search Terms

I started my research by using the two mentioned terms (operational and digital backbone) in the scientific databases EBSCO and Google Scholar. As predicted, this initial search only generated few results. For operational backbone I received 17 and for digital backbone 78 results, the majority of which are referring to unrelated topics. Therefore, I had to extend the list of my search terms. Even though using more general terms (i.e. Digital Transformation or IT Architecture) significantly increased the number of results, they were still too unspecific and unrelated. As a consequence, it was necessary to combine certain terms:

- Digital Transformation & IT Infrastructure,
- Digital Transformation & Enterprise Architecture,
- Platform & Architecture,
- IT Infrastructure & Innovation.

Nevertheless, the number of relevant results in scientific databases remained very low. Therefore, I extended my research from scientific databases to websites of specific journals such as the Harvard Business Review or even journals published by consulting agencies like McKinsey.

3.2 Iterative Research

The process of searching and identifying literature became very iterative. One reason was the already explained challenge of finding appropriate search terms. By scamming and reading more literature on IT infrastructure transformation, I was able to distinguish more terms used to describe this topic. For instance, the article by Bossert et al. (2014) introduced the new term "Two-Speed IT", which I added to the list of my search terms to obtain more results. Besides, I usually looked at the references that relevant papers listed to collect more literature.

In order to identify the relevant papers for my research question, I always started by reading the abstract in scientific papers or scamming through the journal articles. If these were applicable, I began with the detailed analysis of the content. It took some time in the beginning to identify common statements within the papers and aggregate them accordingly to key aspects. Afterwards I reread the first papers to match their statements to these key aspects. Moreover, I then searched for papers referring to one specific key aspect, for example to big data and analytics.

During this entire iterative process of finding literature, adding new search terms, identifying the key framework and rereading literature I always had to consider two things. First, it was essential to determine when to phrase a key aspect that was agreed on by multiple authors. Second, the topic investigated in this paper has many overlaps with other subjects. For example, the area of digital transformation in general or the theme of adapting existing business models by using digital tools. Therefore, always keeping the research question in mind while searching and reading literature was essential for me.

In the end, I identified 13 relevant papers which were published between 2010 and 2019. Six of those are scientific papers, four are articles from the consulting agency McKinsey and the remaining three are other articles in academical journals. The dates of publications are almost equally distributed over time, with a climax of publications in 2018. Figure 1 illustrates this distribution of all papers.

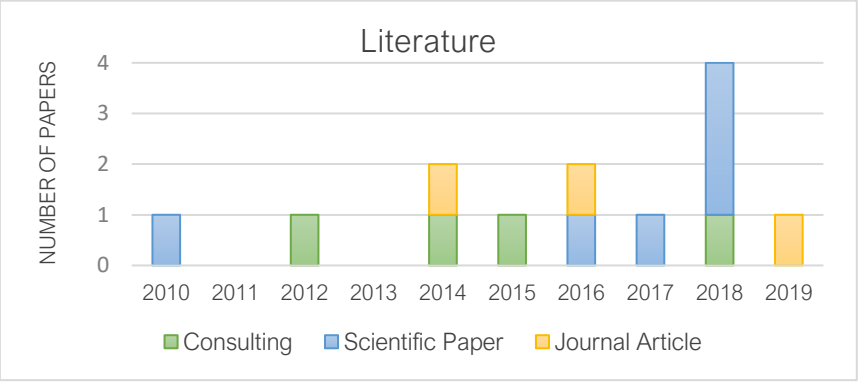

Figure 1. Identified Literature over time and by category

4 Findings

For the key framework I discovered three main aspects per backbone. After explaining these principles for each backbone, I will focus on the question why both backbones should be kept separate and how nevertheless a suitable combination of both systems can bring further advantages. It is important to highlight that the framework in this paper is designed from an overarching management perspective rather than from a deep technical perspective. Therefore, general guidelines for the transition process of the systems are presented and less attention is paid to concrete architectural details.

To get a short overview of the findings in the different papers, I created the concept table, added in the *Appendix: Concept* Matrix. Although I identified 13 relevant papers, only eleven are listed in this concept table. The reason for this is that Winkler and Kettunen (2018) as well as Gampfer (2018) provide a more general view on the importance of both backbones and do not directly contribute to the aspects in the following sections.

4.1 Key Framework for the Operational Backbone

As I summarized in the definition, the operational backbone is the basis for operational excellence. It enables efficient, stable and reliable core operations (Ross *et al.*, 2016). In order to build such an operational backbone, it is essential to keep three key principles in mind. First, the business needs to be actively involved. Second, the operational backbone must be able to provide a transparent overview over the business performance. And third, it should enable all employees to be more efficient in their daily work.

4.1.1 Business Involvement as Key to Building an Operational Backbone

The IT department has been a stand-alone show for a very long time. But in a digital age, it becomes more and more important to not see IT applications and infrastructure as a silo, but rather as an enabler for an efficient business operation (Blumberg *et al.*, 2018). To build this enabling role, the involvement of the business departments is essential (Andersson *et al.*, 2012). Therefore, both IT and the business units need to leave their classical silo-mindset and the ancient borderlines behind and start working together in a new integrated way. Obviously, it takes time to establish such a new way of working together. However, it constitutes a significant basis for building an operational backbone and therefore has to occur before transforming the IT infrastructure (Bossert *et al.*, 2014).

While working side by side, the IT can gain insights into the business needs and processes. Only in this way they can further develop and innovate the IT systems more demand-oriented instead of just running them passively and reacting to error messages (Andersson *et al.*, 2012). Hereby it is important to not look only at particular processes but rather keep the big picture in mind. This refers to the entire business model of the company, which in addition to the value proposition also includes the value network (creation, capture, delivery). The transformation of IT systems is not about changing the existing value proposition but instead about improving the core operations and the value network around that. To achieve this, a company needs to consider two things.

First, the digital tools and transformation plan need to fit the existing value proposition that is analysed before alongside with the business units (Furr and Shipolov, 2019). Second, the value network around the proposition can be restructured in order to improve core operations (Garcia Avendillo *et al.*, 2015). For that, business structures and processes to create, capture or deliver the value proposition need to be analysed and eventually changed in line with the IT infrastructure, so both go hand in hand and improve the overall performance (Nathe, 2016).

One last point to keep in mind when involving the business is to additionally involve the Top Management into the transformation. As building an operational backbone is relevant and crucial for the success of the entire company, the topic needs to be discussed and decided on a high Management level (Blumberg *et al.*, 2018). Especially in ancient incumbent enterprises where a certain hierarchical way of thinking is still present, a top-down commitment and support for the transformation process are indispensable. Therefore, the CIO (Chief Information Officer), being responsible for the IT units, and the CEO (Chief Executive Officer) need to have a shared understanding of the business problems and challenges as well as the role of IT systems in it (Delmond *et al.*, 2017). Only with this common understanding, they are able to constantly align the overall strategy with the IT infrastructure strategy (Garcia Avendillo *et al.*, 2015).

Only by following all these points above and achieving an active participation of the business, the IT can become an enabler for efficient core operations.

4.1.2 Transparency over Business Performance

After analysing the core operations together with the business units, it is essential to gain transparency over those processes (Ross *et al.*, 2016). Several key performance indicators (KPIs) have to be defined by the business as well as the IT units in order to first analyse the process itself but secondly also investigate the IT performance within it (Furr and Shipolov, 2019).

As the operational backbone needs to be built to allow such transparent analysis of KPIs, one major principle is relevant: there can only be one single point of truth for core business data. This includes for example product, customer or order data (Ross *et al.*, 2016). In contrast to the digital backbone, where we intentionally want to collect as much data as possible from many sources, in the operational backbone one data source system has to be defined and maintained (Furr and Shipolov, 2019).

4.1.3 Enable Greater Employee Efficiency

Besides aligning the IT transformation with the business needs and gaining transparency over core operations, the third key aspect to building an operation backbone is enabling employee efficiency. This includes the deployment of automated, standardized and shared services alongside with device mobility.

The first step towards employee efficiency is automating repetitive processes. This not only improves the overall speed but also accuracy and reliability of the outcome. Such automated processes give employee the chance to allocate their resource to other more important tasks. Additionally they allow enterprises to scale up their operations more quickly and efficiently (Ross *et al.*, 2016).

The second step is the creation of standardized and shared back office services (Ross *et al.*, 2016). These services as well as standard IT applications should be shared by all business departments (Delmond *et al.*, 2017). However, within such standardized services it is important to provide end-users with the possibility of making small adjustments themselves. Thereby some customized needs can be satisfied directly by the business end-user and don't always become a time-consuming change request carried out by the IT department (Bossert *et al.*, 2014).

The third option to enable efficient day-to-day business is creating a so-called device mobility. This includes for example BYOD-concepts (Bring your own device), virtual desktops and communication systems that allow employees to work more flexibly (Andersson *et al.*, 2012).

4.2 Key Framework for the Digital Backbone

The digital backbone is essential to capture digital opportunities (Ross *et al.*, 2016). The IT infrastructure needs to be designed to enable fast iterative and customer-centric innovation (Garcia Avendillo *et al.*, 2015). To achieve this, there are three major key principles: big data alongside analytics, modular IT set up, and agile development teams. If you have direct data access to your customer in combination with real time analytics, you can immediately identify their changing wishes and expectations. Having a flexible IT infrastructure with modular applications as well as an agile and flexible team set up, it is possible to adjust your business activities accordingly and thereby gain a major competitive advantage (Delmond *et al.*, 2017).

Two successful examples that followed these guidelines when building their digital backbone are the companies Dell and GE. On one hand, Dell accelerated their development speed by incremental applications and also by setting up decentralized IT teams. Thereby they gained flexibility in their digital backbone and improved their innovation processes (Delmond *et al.*, 2017). On the other hand, an independent development team at GE built a platform as a basis for different application from inside the company as well as the outside. This platform also included massive amount of sensor data from their products and data analytics in combination with machine learning. That is why they were able to gain predictive information on their products and achieved a superior competitive advantage (Iansiti and Lakhani, 2014). Both enterprises followed the key framework that I will now describe in more detail.

4.2.1 Big Data and analytics

In contrast to the operational backbone, one key aspect of the digital backbone is to collect as much data as possible. The digital backbone has to be built in order to store this massive amount of big data (Andersson *et al.*, 2012). It is essential to collect different data types from different sources, for example public data, social media data or product data (Ross *et al.*, 2016). This so-called product data comes from different sensors that are built into the products and collect data about the product performance (Kaidalova *et al.*, 2018).

Moreover, an analytics engine is required that can extract relevant information from all the data (Andersson *et al.*, 2012). Thereby valuable insights for example into product performance or customer behaviour on social media can be acquired (Ross *et al.*, 2016). To avoid any delays in the evaluations, these data analytics happen directly in real time as data is collected (Bossert *et al.*, 2014).

As mentioned before, the further advantages derive from combining both backbones. This is especially the case for combining the data storages. Big data and analytics from public or product sources are less beneficial as a stand-alone solution. They need to be joined with the meta-data in the operation backbone (Bossert *et al.*, 2014). I will return to this combination process later in the paper during chapter *4.3 Linking both Backbones*.

4.2.2 Enable Fast Innovation through Modular Applications

The second aspect in the framework to achieve flexibility in the digital backbone is a modular IT set up with different applications and microservices (Bossert *et al.*, 2014). With such incremental parts in the IT infrastructure, it is possible to accelerate the development speed of new features (Delmond *et al.*, 2017). As customer needs and expectations as well as market surroundings change quickly, the company needs to be able to frequently update its services and make fast turnovers possible (Kaidalova *et al.*, 2018).

To integrate such autonomous, fast-changing and demand-oriented applications, there has to be a platform as the according ecosystem (Ross *et al.*, 2016). This platform, hosted by the company, serves as a backbone for all internal applications but also as an opportunity to enable open innovation from the outside. This open innovation approach enables on one hand cocreation by partners within the market and on the other hand also cocreation by the customers (Delmond *et al.*, 2017).

At the same time with such an open platform for different applications, the company doesn't want to put the stable running core IT and operations at risk (Nathe, 2016). This is one reason why both backbones need to be kept separate (Delmond *et al.*, 2017), which I will specify later on in chapter *4.3 Linking both Backbones.*

4.2.3 Agile and Flexible Teams

Big data and analytics as well as a flexible IT infrastructure for independent microservices usually require different knowledge and resources than the stable running core IT systems. For both backbones different types of employees with different skill sets, mind-sets and working routine are essential (Kaidalova *et al.*, 2018).

For building a digital backbone, small agile DevOps (Development and Operations) teams with digital skills are necessary. This agile set-up is designed for the rapid development cycles and fast changing environment I mentioned before (Garcia Avendillo *et al.*, 2015). As people in those small agile teams need to have a different mindset, it is highly recommended to acquire new employees that do not bring burdens from former (legacy) projects or prejudices into the new development (Nathe, 2016).

To further establish this innovation process, it is not enough to only hire new talents with digital skills. A new innovation culture around the team and the business units involved in the transformation must be established as well (Andersson *et al.*, 2012).

4.3 Linking both Backbones

As I mentioned in the beginning of this paper, both separate backbones are essential in order to achieve the "efficiency, reliability, speed and agility that the competitive environment was demanding" (Ross *et al.*, 2016, p. 11).

The operational backbone has long-term components and enables efficient core operations (Gampfer, 2018). It therefore has very high expectations on quality and perfection to be a stable enabler of the core business (Bossert *et al.*, 2014). This obviously slows innovation and adaptation down which is why the digital backbone is needed additionally. This backbone facilitates short-term flexibility (Gampfer, 2018), rapid adaptation to different customer needs as well as constant testing and experimenting. A lower quality is therefore acceptable in exchange for fast innovation. To sum up, a clear distinction between the two IT infrastructures as well as the manifestation of this understanding are needed (Bossert *et al.*, 2014).

4.3.1 Benefit and Challenge in Linking Separate Backbones

However, neither backbone is very sufficient as a stand-alone solution. The real benefit and also the greatest challenge lie in linking specific aspects of both backbones with an appropriate approach. This approach starts by following the correct order in the transformation. Additionally, both data pools as well as the different teams and mindsets must be brought together. By following these three points, the benefits from both backbones can be maximized and the company can scale innovation in the digital backbone much faster, as it is linked to a good working operational backbone.

Even though the benefits of linking both backbones are clearly highlighted, there is also critic on this challenging part. According to Garcia Avendillo *et al.* (2015), the linking process might fail or not even be started as the focus is too much on the new fancy digital IT and less on the old core systems. Additionally, there might not be an overall roadmap or strategy for linking both so the company gets caught up in a cycle with no improvement at all. Especially for the linking process, the business involvement is crucial. These show-stoppers need to be considered when building both backbones and trying to link them. Otherwise the expected benefit of transforming the IT infrastructure might not become true and the whole transformation is at stake.

4.3.2 Approach for linking both backbones

First, when starting the IT transformation process, the core architecture in the operational backbone should be clearly defined from the beginning, so that uncertainties don't slow down the entire process (Bossert *et al.*, 2014). Only afterwards the new fast digital backbone can be built on top (Ross *et al.*, 2016). Overall it is essential to have a stable working core IT backbone so it can be combined with a digital backbone and unfold all the benefits described (Nathe, 2016).

Second, as soon as both backbones work sufficiently and stable on their own, both data pools need to be linked (Bossert *et al.*, 2014). For example, the IoT sensor data collected and analysed in the digital backbone is much more valuable when combined with core business data (for example services contract data). Data analysis can then make more accurate statements, conclusions or predictions (Ross *et al.*, 2016). With better predictions, it is possible to create more customized products and services and then achieve greater customer loyalty which result into competitive advantage (Bhatt *et al.*, 2010). Another example for how to improve core operations by linking both data pools is the company Dell. They used all the customer data they collected in the digital backbone to then optimize their core operations such as the inventory stock management (Delmond *et al.*, 2017).

Third, besides linking the backbones on a technical level, both teams need to be brought together on an organizational level. In both backbones the people work with different approaches, programming languages and mind-sets (Garcia Avendillo *et al.*, 2015). To align both teams and visions an insider-role is needed. This insider is familiar with both teams and working methods and therefore able to link the governance and architectural guidelines of both IT backbones (Kaidalova *et al.*, 2018).

In addition to this point-to-point connection via an insider, general organizational restructuring is required. The overall culture needs to change in order to create sustainable benefits from linking both backbones. First, the IT department should no longer be seen as a silo-department, but rather as an integrated service. This transformation starting in the IT department then infiltrates the whole structure and culture of the entire enterprise (Ross *et al.*, 2016). Second, having this more cross-functional culture and perception, it is easier to combine the different project management approaches. While the operational backbone uses the classical waterfall model, the digital backbone works with an agile approach (Ross *et al.*, 2016). With those different approaches also come different planning timespans and different working principles. One possible solution to merge them could be a so-called hybrid project management for the core IT, which makes synchronizing activities with the agile digital backbone much easier (Nathe, 2016).

5 Discussion

After presenting my findings in the literature, I now want to discuss some of these aspects. First, I highlight some differences between the authors. Afterwards, I discuss some practical implications that help companies to actually perform this transformation of the IT infrastructure. Finally, I describe two areas that are suitable for further research and shortly list the limitations of my research.

5.1 Differences in Findings

During my research I noticed that most authors suggest similar approaches regarding the transformation of IT infrastructure. The greatest approval for building an operational backbone lies in the business involvement. In contrast to this the three aspects for the digital backbone are equally distributed among the literature. In the Appendix: *Concept* Matrix I listed all literature and the concepts they mention. In addition, even though both separate backbones are considered relevant, many authors agree that the real benefit comes when linking both backbones in specific ways. However, some disagreement occurs when discussing the technical linkage of both data pools as well as the chronical order in the transformation.

Usually the majority agrees that it is essential to link both backbones and especially the two data pools on a technical level. In spite of this, there are only few different approaches on how to actually link them. One approach suggests to integrate the digital backbone application by using application programming interface (API's) (Blumberg *et al.*, 2018). However, these point-to-point connections can become very complex and inefficient especially with increasing number of applications. That is why the second approach is linking the front-end applications via a middleware interface to the legacy backend systems in the operational backbone (Furr and Shipolov, 2019). In this approach the connection can be monitored and overseen more easily, but both backbones are more dependent on each other and not clearly separated like other authors highly recommend.

Due to their different approach on linking the backbones, Furr and Shipolov (2019) also disagree with other authors on the chronological order in the transformation. They suggest to start with building front-end applications in the digital backbone as it usually can be achieved very faster and creates direct benefits. Afterwards the legacy systems behind the innovative front-end should slowly be adapted.

5.2 Practical Implications

Within this paper I summarize a framework that companies can rely on during their IT infrastructure transformation process. When building an operational backbone, the business departments need to be actively involved from the beginning. Besides, one single data source has to be defined and maintained to achieve transparency over business operation. Finally, the implementation of automated as well as standardized services enable employees to be efficient in their daily work. In contrast, for the digital backbone a large amount of data has to be collected and analysed. To achieve fast innovations a modular set up of independent applications is necessary and overall to build a digital backbone, the company has to establish an agile and flexible working culture. Moreover, both backbones have to be aligned and combined with a suitable approach. If companies consider those principles within the framework, a

successful transformation is possible. Nevertheless, each company has to identify their target architecture (i.e. systems, teams and data sources) individually according to their overall digital strategy. The principles I discovered only serve as general guidelines during the process towards their individual target architecture.

However, in practice it requires time and resources to build, operate and improve two separate backbones constantly. If those resources are critical components, companies can't achieve an entire transformation following all aspects described within this paper. Consequently, the company is forced to focus on specific capabilities. If it is already too late to start a significant change in the operational backbone, some "quick wins" and "short cuts" need to be found. In line with the overall strategy the management has to set priorities and keep their focus instead of trying to implement all at once (Ross *et al.*, 2016).

Especially small or middle-class companies struggle with such a huge transformation of their entire IT architecture. Often resources, skills or time are missing for an extensive change within the company. To overcome this problem, Nathe (2016) suggests an approach to transform step-by-step along customer journeys. In that approach due to limited resources both backbones are combined from the beginning as there is often only one project team consisting of business analysts and IT specialists. This transformation process includes eight steps, that are shown in Figure 2. Basically, according to the overall digital strategy, a specific customer journey is selected and described. Afterwards the necessary business capabilities for this customer journey are defined as well as the current ones are analysed. The same target definition and situation analysis occur for the IT architecture. Afterwards a transformation plan is set up to achieve the target situation and finally the implementation of that transformation plan is carried out simultaneously for the slow (operational backbone) and fast (digital backbone) IT.

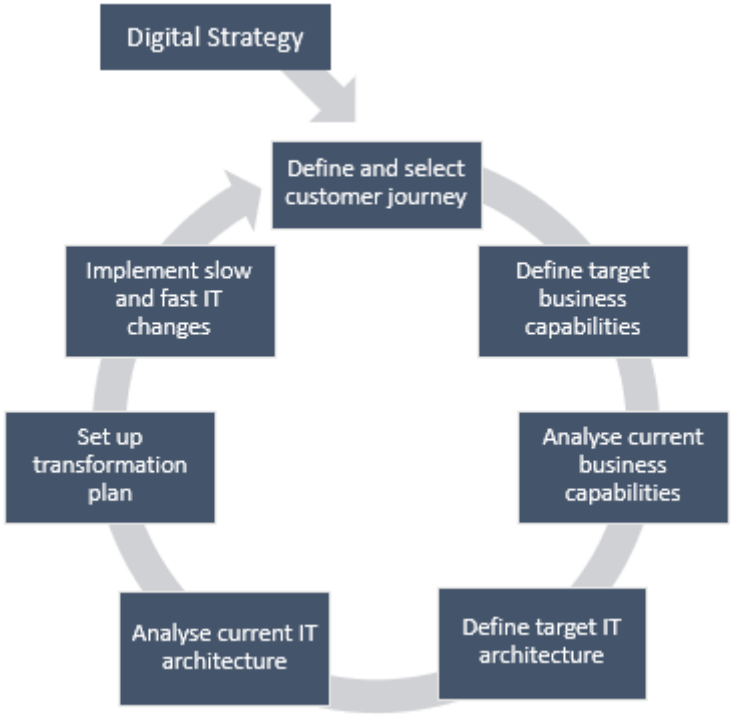

Figure 2. Transformation process along a customer journey (Nathe, 2016)

To sum up, if time or resources are not available for an entire transformation process, the company should focus on specific aspects that are complementing their digital strategy (Ross *et al.*, 2016). One approach is transforming along a certain customer journey (Nathe, 2016).

5.3 Future Research

During my research I detected two areas where further research can be conducted. The first area is a more technical analysis of building both backbones and linking them. Second, supplementary research on practical approaches for a simplified transformation can be helpful especially for smaller companies.

The research that I performed as well as the findings focus more on the management perspective. Many authors define from a management view how the transformation process should happen on the overall organizational level. As I concluded before in chapter 5.1, there is only few information about the exact technical transformation. Therefore, I recommend future research to focus on the technical components of both backbones as well as the connection of different data pools and applications.

As time and resources are usually a critical factor in the real world, the realization of an entire IT architecture transformation proves to be unrealistic. Future research can therefore focus on more practical approaches like the one Nathe (2016) suggested along one specific customer journey. In this area some case studies that analyse different alternatives in smaller enterprises may provide further insights and implications for a lite version of an IT infrastructure transformation.

5.4 Limitations

It is important to mention that this paper and its findings have some limitation because of two reasons. First the terms operational and digital backbones are no established terms. This results into the risk of missing relevant literature that used deviating terms to describe their findings. Second, the identified literature includes papers from consulting agencies. Those papers may present only a certain view or opinion of single consultants. Furthermore, these insights could be frameworks developed for one specific case and not be effective for other enterprises. Finally, it is important to highlight that the transformation of IT systems is a current topic with ongoing research. It may be the case that after this publication more additional or even contrary aspects are discovered. Moreover, as times goes by, case studies on already transformed enterprises can bring further scientific proof for the effectiveness of the framework described in this paper.

6 Conclusion

In order to survive in the current competitive environment and make the best possible use of new digital opportunities, a well-founded digital strategy is required. An IT basis is indispensable for successfully implementing this strategy (Ross *et al.*, 2016). Many incumbents do not currently have this basis and are therefore forced to adapt their IT infrastructure (Garcia Avendillo *et al.*, 2015). A stable operational backbone must be established and at the same time, the digital backbone will provide flexibility for rapid innovation and adaptation (Furr and Shipolov, 2019). Answering the research question mentioned in the beginning, this paper provides a framework for such a transformation. Nevertheless, within these guidelines there are many different approaches to actually modify the IT infrastructure. Which exact approach a company finally chooses depends on the overall digital strategy of a company and many other factors like the market pressure to transform or the resources available.

In order to select the appropriate approach, three things must be made clear. First, above all, it is essential to internalize the current relevance of IT infrastructure for the overall success of the company. Additionally, the concrete role that the individual IT systems play in the company's core operations needs to be identified. Second, the entire digital transformation strategy of the company must then be clearly defined and communicated. And third, this overall strategy must then be broken down to the individual IT systems. This creates a concrete target architecture, which can then be set up with the help of the concepts described in this paper. Throughout this process the company needs to be really self-critical and commit to the transformation. Otherwise they just try to work around, which in the long run only increases operating costs and proves to be inefficient. Over time companies without a thoughtful strategy for their IT infrastructure and the commitment to follow through with it will not survive rapidly changing market environment.

7 Appendix: Concept Matrix

	Key aspects operational backbone			**Key aspect digital backbone**			**Linking both**		
	Business In-volvement	Transpar-ency and Data	Employee efficiency	Big Data & Analytics	Modular setup	Agile and flexible teams	Operational backbone first	Linking both data pools	Linking people
Andersson et al., 2012	X		X	X		X			
Bhatt et al., 2010								X	
(Blumberg *et al.*, 2018)	X								
Bossert et al., 2014	X		X	X	X		X	X	
Delmond et al., 2017	X		X		X			X	
Furr and Shipolov, 2019	X	X							
Garcia Avendillo et al., 2015	X					X			X
Iansiti and Lakhani, 2014				X					
Kaidalova et al., 2018				X	X	X			X
Nathe, 2016	X				X	X	X		X
Ross et al., 2016	X	X	X	X	X		X	X	X

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