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Review Paper

Some New Trends of Digital Transformation in Business

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ABSTRACT

This paper presents some current challenges facing the digital transformation process in business. First, we'll introduce the fundamental laws of technology that underpin today's business disruptions and outline some of the economics behind them. The paper then dives deeper into a smaller group of high-profile digital technologies to understand how they work, their specific dynamics, business impact, and associated challenges. Finally, we will show how businesses can put together a digital transformation program from business strategy to organization and technology.

Keywords: digital transformation, digital business, big data, cloud.

INTRODUCTION

Our first goal is to build a common understanding of the basic concepts behind the phenomenon of digital transformation. So, we're going to study technology platforms together, understanding what really makes digital technology so special and hard to spot. What sets it apart from the cutting-edge technological advancements we've seen. Take for example the 18th century with the First Industrial Revolution [1]. You see we can break it down into three basic laws of amazing improvement when digitized information is *processed*, *transmitted*, and *stored*.

In fact, when we follow one of these laws, it is interesting that they all obey the laws of exponential growth. So, we'll start there, then discuss its impact on the business environment, and we'll discuss it from two angles. First, impact on the traditional business structure of all industries. In other words, it is how the relationship between economic agents is increasing in the value chain. Second, the impact on individual companies. Consider how revenue and profit are affected by technology investments. Innovation and technological change are at the heart of human development, and they can also make a breakthrough to the current situation.

LITERATURE REVIEW

Now, we'll take a few fairly recent examples of how digital innovation and technological change have impacted industries and individual companies.

It's really fascinating how rapidly technology evolves over time. Decades ago, no one around us owned a mobile phone. We only have one landline, reserved for important purposes and emergencies only. We listen to FM radio and pre-recorded songs via cassettes. The Internet was still a theoretical idea at that time. Online courses are only in the sci-fi books. And now, not too long after, everyone has a smartphone. We shop, chat, play, and learn online. We cannot imagine life without the Internet. Within 15, 20 years, digital technology has not only changed our personal lives, but has completely changed the world of business and no industry is an exception.

Digital technology over the past few decades has evolved very rapidly, to speak, at an exponential rate. To see that, we will condense this process into three basic laws that make everything possible. These rules refer to the core concepts, core aspects of digital information management: Processing, transmission and storage.

First, let’s start with Moore's law [2]. This law states that every 18 months, your computer doubles its ability to process information. Originally, it was built a little differently. This law says that, on a given silicon chip, every 18 months you can double the number of transistors on that chip. The fact that this law in its original form is challenged by the more transistors in the same surface, you will have such a high density that quantum effects will occur and preclude the way the processor is designed to operate. But it can be said that this challenge is only temporary, not permanent. We can change the designs from 2D chip to 3D. We can change the material we use, instead of silicone, we can use graphite and we even quickly change our approach and move towards quantum science.

Next is Butter's Law [3, 4, 5]. This law states that the amount of data transmitted over a single fibre will double every nine months. If you plot the typical speed and megabytes per second on the log graph, you will see a straight line, which means there is an exponential increase over the years. There is a variation of this law for other media, wireline like ADSL, VDSL or wireless like 3G, LTE and most recently 5G.

The other law is known as Kryder's Law [6]. This law refers to hard drive storage capacity and states that the amount of data stored per square centimetre of a hard drive doubles every 13 months. At least, this was the case in the late 90s and early 2000s, when Mark Kryder formulated his observations. In fact, this trend has slowed down, it will double every 16 or 17 months. But, no matter what, this law still holds speed even faster than Moore's law.

As such, it can be seen that the exponential growth of processing power, communication bandwidth and storage capacity is the technological foundation of any digital transformation today. Second, our minds are tuned to see and predict linear developments, so the first challenge both individuals and businesses need to overcome is technology awareness. How numbers are growing. And finally, a gap will often appear between a company's growth and technological potential, which is often filled by start-ups that arise to disrupt existing ones. In the next section we will learn about this destructive process.

Value chains and the deconstruction

Historically, the architecture that we often use to describe how businesses are organized in a given industry has been the value chain, a vertically integrated chain [7]. In this model, an industry can be viewed as a continuation of many suppliers, manufacturers, and distributors. Collectively, they convert raw inputs into market-ready materials, all at the same time. A company typically integrates multiple steps in the value chain to become an exclusive member with a few other vertically integrated competitors.

Vertical integration is a suitable strategy for managing the flow of goods and information. There are two reasons for this. The first is the high transaction costs. A company needs a lot of resources and time to arrange its value chain, to coordinate with many suppliers and distributors to find the best price for the product or the right quality standard. As a result, there are fewer transactions in the value chain, which means lower costs and faster time to market. The second reason is that in many industries, competitive advantage is driven by scale. For example, the more phones a company makes, the more their experience will be translated into efficiency and the more profitable their business will be.

You may find that there are many reasons surrounding information: Information gathering, information exchange, and information processing. And this is an area where digital technology has changed very quickly over the years. If you recall the three fundamental laws from the previous video, we described how some technological advancements are brought to the user at a reduced cost. As a result, it is becoming cheaper to store, process and communicate digital information. In fact, it's exponentially cheaper for companies to directly check the inventory of third-party distributors through an ERP integration as an example, or instantly compare suppliers' prices. offered through an online auction portal. These are examples of transaction cost reductions. It affects almost any industry you can think of. And one of its main consequences is that the links in the vertically integrated value chain become looser and begin to break. In this way, it will become different tiers serving the same purposes as before in the industry. But, this time, each tier consists of several independent companies, interacting independently and also with other layers. This independence and interoperability allow each tier to develop its own critical success factors. Several tiers will be affected by size, so businesses will merge spontaneously, sometimes reaching the point of building a monopoly empire. There are floors that require a lot of creativity and flexibility, so businesses will function separately.

Let's look at an example of a story of structural disruption in the telecommunication sector. In the 20th century, the telephone was offered as a complete service. A single company will install fixed lines to homes, manufacture handsets, and operate equipment as well. The industry's first stratification comes after a long legal battle allowing customers - I know this will surprise you - to use phones that aren't made by carriers. Technically, this could have happened in the 20s, but this legal battle was only settled in the mid-50s. Then in the 80s a second stratification took place. Different service providers can rely on a common infrastructure operated by a third party, a unit that also benefits greatly from scale. Then in the 90s with the advent of the internet, new services began to be provided by new businesses who were the leading service providers, not only in voice calling services but also telephony services. news, entertainment, and very, very quickly e-commerce. Disrupting the structure of the value chain allows companies in each tier to compete on the critical points of their particular function. At the bottom, the key to success is scale. Fewer businesses are involved but are large enough to optimize investments and make the most of very valuable assets. There is no benefit to having 5 fibre optic network providers in a city, while only 1 is enough. However, the top floor is completely innovation. New services may emerge and be tested with customers. They can succeed or fail without having any effect on the lower layers. This is the highlight of the cascading structure. Over time, they will even allow new business models to hit the mainstream of existing service providers. Companies like Skype or WhatsApp, for example, completely destroy the market value of messaging. They are even taking the revenue of voice calls and putting pressure on the cost structure of existing businesses. Telecommunications is not the only industry to be structurally disrupted. Banks or even the old energy industry are also the examples.

What does that mean for existing businesses? This means that the competitive landscape has changed dramatically. In addition to traditional competitors, existing businesses can now be attacked by smaller competitors that target only a few specific tiers of industry tiers. For example, Traditionally, carriers worry about other carriers. Today, they fear about WhatsApp as we talked about, or Netflix. Both of these companies use telecommunications infrastructure, but they use it in a way that destroys a range of traditional values of the infrastructure operators themselves.

In short, technological advancement changes the traditional model of business architecture, from a vertically integrated value chain to a multi-tiered structure. This multi-tier structure reflects the fact that units can compete on different success determinants in different classes; scale at the bottom, innovation at the top. In this new model, new businesses can disrupt existing businesses by attacking a certain part of the value chain.

Competitive Life Cycle and Product Lifecycle

Digital transformation can lead to many problems, but there have also been observations of common patterns in the impact of transformation and disruption across industries over time. This leads to what we call the *competitive life cycle* [8]. Competitive lifecycles are similar in concept to *product lifecycles* [9] but they are seen at the industry level rather than at the level of the product itself.

The first observation that we see with the competitive life cycle is an *S-shaped curve* [10, 11]. This S-curve refers to a common pattern of sales or revenue over time. In the beginning, when a new technology or field is born, everything is explored. Hopefully, you'll hit the sweet spot, when your technology takes off and that's the steepest part of the S-curve. And eventually, maybe you'll exploit the market and this S-curve. will start to curve and you will probably hit sustainable sales. Therefore, when viewed from the point of view of revenue accumulation, we will see this S curve gradually over time.

We can also think of three different stages a technology goes through: *incubation*, *pulsation*, and *disruption*. Let's talk about the incubation period. Incubation is the stage where an idea is incorporated around what we call the mainstream design of the technology. Basically, find out how this technology will evolve in the future. The turbulence phase refers to what happens to a few competitors in the same field. Let's look at it. If we focus on a few companies in the same industry, we often see the following pattern. Initially, a few brave entrepreneurs or a few incumbents entered the market. As the market started to develop and grow, other businesses also joined because they saw the market opportunity. More often than not, they're going to experience competition, there are too many players in the market, and as the shuffle unfolds, we'll see companies either go bankrupt, or merge and buy another firm which will limit the total number of firms in the market. One of the interesting questions is, how severe will this disturbance be? Previously, we talked about markets where the winner takes it all, and obviously, the winner is the last person standing in the market. In other areas, they may allow more business in the market. One of the things we have to think about is, what could be the outcome of the competitive life cycle in a particular area of interest? Finally, once again we need to consider what will happen to the profits. Profit is probably the most important consideration, and it has a lot of variation. In the beginning, in many fields, profits can even be negative. In fact, there probably won't be any profits made in this industry. But hopefully, as the business begins to grow, profits will improve. But as we discussed, competition will also increase, and when competition starts to increase, it is often the case that revenue will be suppressed. How they will end is an open question and there are many factors that determine whether this is a profitable business. Let me take an example, we have data on the auto industry. And what you see here is that the auto industry at the end of the 19th century started to emerge and grow, and we see a huge entry by hundreds of different competitors in the same field. Then, over a period of about 20 years, the next competition broke out leading to turmoil. In the United States, there are three remaining businesses that we call the Top Three Manufacturers, namely General Motors, Ford, and Chrysler. We also see similar patterns in other countries around the world. And then that structure dominated for the next several decades.

Digital Trends from Yesterday to Today

The next part of the paper will present digital trends. In previous sections, we discussed the fundamental laws behind recent advances in digital technology, and saw how these laws affect individuals, businesses, and the whole industry. In the next section, we'll take a closer and narrower look at the technology trends we've seen in recent years. This section focuses on the trends that we believe have the strongest impact on the business environment.

We'll start with Big Data and see how it creates value for businesses that take advantage of it. Regarding Big Data, we will discuss Cloud Technology, and the opportunity for companies to outsource different parts of the platform to run applications or even their business processes.

Big Data

During the 80s and 90s the world's installed storage capacity was steadily growing at 20 percent per year. Interestingly, at that time, more than 95% of the information stored was analog and only 5% was digital. The analog format is basically your radio tape, your photo, the movie at the theatre at the time. But then something unexpectedly happened. Digital has begun to become the default storage format for information. In 2000 it accounted for 25 percent of all information stored. With about 55 exabytes. That's 55 billion megabytes. And if you remember our three fundamental laws, you should be able to tell how this is going. Very quickly, by 2003, we were living in that magical moment, when you had as much digital information as analog. In 2007 digital information exploded. up to 94% of the world's storage capacity. What's interesting here is the fact that this information is more and more likely to be stored on a laptop, on a mobile phone or on a server with a globally connected IP address in a network. This means that the ability to link different pieces of information, relate them, build inferences becomes almost easy, and this has a multiplier effect on the value you can extract. get from it. But first let's see how the amount of data has grown since then. In 2007, as we said, we had 300 exabytes of data. Today, we’ve exceeded 4,000 exabytes, and IDC expects the number to reach 40 zettabytes by 2021. That's 40,000 exabytes. You can pause this video for a minute and see how many hard drives you need like the one you have at home to store all this data. I don’t know what hard drive you have but I bet it will be a huge number.

So, what is really big data? Big data is defined by what we call the three “V” letters. Big data is big. So, it is first determined by its *quantity*. Every minute 156 million emails and 452,000 tweets are sent worldwide. Remember we're talking zettabytes of data. There are also many types of data. So second, big data is defined by its diversity. Data is not only collected during structured interactions, when you fill out an online form or you use your credit card. More and more data are being stored in hard-to-mine formats with no structure, images, speech in multiple languages, or videos like this one. Last but not least big data is very fast. So, it is determined by its *velocity*. Do you remember the days when we wrote letters, how long it took to send them abroad? Today, we communicate with friends around the world in near real time by chat or video call. So, big data means having zettabytes of data that is in an unstructured format and can be exchanged in real time, which then again contributes to the growth of the data and thus the growth of the data. increase in the amount of data. Now you can recognize big data when you see it, at least technically because when I act as a business person, I see there is a missing fourth V. Because a company has a bunch of servers where it dumps every piece of data, it doesn't make it a big data business. A company needs to be able to turn that data into a competitive advantage in order to create value and business impact from it.

In the following, we will analyse a few examples of how Big Data is used in different industries. The most common use of Big Data is being able to personalize product delivery. Companies like Amazon are prime examples. But Brick and Mortar companies also use Big Data to understand their customers and come up with customized solutions. Do you think you got those coupons from your supermarket by accident? Think again.

Reducing fraud is another example of how Big Data can be used to create value. Credit card companies like Visa analyse billions of transactions to identify unusual patterns and thus reduce fraud in real time. According to Visa, that saves them $2 billion a year.

Big Data can also be used for Predictive Retention. What does that mean? That means a company can use the data it collects about its operations to predict performance problems before they actually happen. This is incredibly valuable especially in asset-focused industries.

For example, an oil and gas customer with hundreds of oil wells on three continents is connected to an analytics platform that integrates data from those facilities and generates insights. This saves over $200,000 annually. And these are just selected examples. Big data has more application areas across all industries, all functions.

Cloud computing technology

There are three common benefits to companies using cloud services: *performance*, *speed* and *cost reduction*. Let’s take a closer look at these three benefits.

Performance: Cloud services can be more reliable when it comes to building disaster recovery mechanisms that many businesses forget or invest little in. They can also provide access to peak productivity that would not be economically feasible to build on their own.

Fast (Speed): Not only are cloud services quick to set up, they can also scale as the business grows. They allow for seamless and prepared equipment upgrades.

Reducing costs is a challenge. In theory, we know that a cloud service especially at the lower layers is an enterprise at scale. If we take out migration and other legal costs, you can get two types of cost benefits from the Cloud. First, using a cloud service can reduce a company's upfront investment, capital costs. This is especially important if there is high uncertainty about the actual power required over time. Therefore, choosing a pay-per-use model can reduce the risk of overinvesting when you're starting out. Second, a cloud service can reduce the total cost of owning your hardware or software, and even the people needed to run the application. The important thing here is to look at the total cost. I have many times seen IT or procurement department make the wrong decision because they forgot factor in maintenance or upgrading cost or any other kind of hidden cost when comparing multiple solutions. Of course, the degree of cost reduction will vary greatly depending on business needs and starting point. For a typical company, the cloud reduces spending significantly compared to not using the cloud. This can lead to savings of 20 to 50% on IT costs.

Now, what should a company keep in mind when using Cloud services? We talked about the need to look closely at the economics and pay attention to the total cost of ownership before making the move. But from a technology perspective, hyper-scalability is the key to a successful Cloud solution. Hyper-scalability is the definition of a scalable architecture that accommodates increased demand. Why is it important? Let me tell you a story. One of our clients, a telecommunications company, started outsourcing their customer relationship management system to a cloud service provider. The reliability and customizability of the solution is of utmost importance. As a result, they purchased a very advanced, highly personalized service. When our client acquired another company, they needed to scale up the solution very quickly to add new stores. However, they realize that extending their Cloud is expensive and time consuming due to the large degree of cloud customization. This causes serious problems and delays in post-merger integration. This is why hyper-scalable solutions already account for 20% of the data-center market, and they are becoming increasingly popular. Let's review the important takeaways from this lesson. Moving to the cloud has become commonplace. It is driven by fundamental change in the technology economy. There are various possibilities to leverage Cloud services from infrastructure to platform, to software, to business process services. A company should choose wisely, balancing business interests with the capacity needs and economies of scale for any solution. Of all the benefits of using a Cloud service, reducing costs is the hardest. Before migrating to the Cloud, a company needs to carefully estimate the total cost of ownership including maintenance, upgrades, and possibly even re-migration. Super scalability is the key. If you design an architecture with a limitation in mind, remember that you are more likely to underestimate than overestimate your future needs.

Data and how to analytics

In the section, we cover data and analytics. You may have heard the term, "*Data is the new oil*." Yes, this analogy still has its limitations, but it hits a point. No matter what digital product or service you are developing today, it will ultimately depend on data. In this section, we want to focus on how a company can actually use data to create value. What capabilities does the company need? What technology is needed? Where should it start? Let's say a company has a customer analytics division and is about to invest in an entirely new data and analytics infrastructure. The first question is, what are you going to do in the first few months with this infrastructure to fully repay your investments? From what we see, it's not the technology infrastructure that makes or breaks data analytics. In reality, a company needs technology and needs to know how to collect, store and analyse data, but this can be developed gradually or can even be outsourced relatively easily.

The key point here is to start with a clear business goal, a clear vision of what the company wants to achieve. This is really the first of four areas where you need to consider carefully when building data and analytics capabilities. The second is data usage. How to translate ambition into tangible functions? The next thing to deal with is data tools. What capabilities does the company need to implement these functions? And finally, a company needs to consider its complete data ecosystem. Who other than the company itself can help develop those capabilities?

We will analyse these four areas in more detail. The first misunderstanding that has been ingrained in many companies' minds is that big data is a technological problem, but it is not. Over the last few years, there have been a lot of terrible stories about losing investments in Hadoop platforms [12] or Data Lakes [13, 14]. Hundreds of millions of dollars, in fact sometimes billions of dollars are invested without a clear business goal. As a result, it all fell apart and had to start all over again. So, if you see a company's data and analytics vision as mastering the best, most advanced technology, you know the risks. Your company's vision doesn't have to be as ambitious as Google's "*reorganize the world's data*." But it needs to align with business goals, and business results. Followed by misunderstandings about data usage. The first is a misunderstanding of emotions. This is one of the cultural barriers to using data as a decision-making tool. Let me be clear, I don't deny that sometimes business leaders have very strong intuitions and foresight about their markets. There's even some interesting psychological research behind this, but you can't run every department and make every decision based on everyone's intuition. And you certainly shouldn't do that when it's an important decision. To create the right data usage options, it is first necessary to foster a culture of data-driven decision-making first.

The second misconception about the use of data is the story related to trust. And you can hear about this misunderstanding in many big companies, in start-ups, and in the media. "*Data security is an issue of the older generation*." Confidentiality is really important to every generation. And not because a teenager would be more comfortable posting photos on Instagram, regardless of how those photos are used. And when we looked at surveys across different countries, we found that there was less variation across generations than across data types. People are more sensitive to the confidentiality of information about their health records than about their shopping habits. In general, companies that want to collect and use customer data need to protect the information so that it is not misused, no matter what generation or group of people they are targeting.

Now let's talk about data tools, technology solutions, data collection, required skills, and alignment to business processes. Data and analytics technology has seen the rise of many prominent keywords over the past few years. The Hadoop platform or cached analytics became mainstream, and some managers started thinking about replacing the entire existing infrastructure. In fact, the birth of airplanes does not replace cars because the two are different exchange solutions. Hadoop or Data Lake will not completely replace data warehouses, as data warehouses are still efficient with structured data that does not require parallel processing. In general, we should not only consider technology solutions in terms of a combination of novelty, novelty and incompleteness, if any, which always comes with certain risks. What matters is the trade-off between the features you need and the cost you're willing to pay. On the data side, I often hear conversations like I'm a B2B business or I'm at support, I'm not as lucky as businesses with tons of data about their end customers. That was clearly a misunderstanding. Big data has many valuable applications, in operations analysis, such as purchasing process optimization, predictive maintenance, logistics optimization and many more. The third misunderstanding in data tools is people. I like to call it the futile search for brilliant data scientists. That is someone who will combine deep IT expertise and outstanding analytical abilities, with great business expertise, and a strong ability to influence decision-making. I can tell you that such people are rare. So, don't put all your trust in such people. Forming a strong team consisting of all different skills is an alternative when there are no outstanding unicorns. Especially when close cooperation in the team is ensured through flexible working method.

There are two more misunderstandings I want to share with you in the fourth area - the data ecosystem. The first misunderstanding is the tendency to believe only what you do yourself. The belief that a company should do everything on its own. The truth is, it is much more efficient to rely on a broader data ecosystem for both data exchange and data analytics support.

And now, the last common misunderstanding I want to talk about is that it's hard to share data publicly outside of your organization's boundaries. This is not quite a common misunderstanding, at least not yet. It is difficult to build a proper relational framework that allows for seamless data sharing. We know that more value can be created when you can combine different data sources to find new and useful patterns. This is also the driving force behind many governments adopting this open data culture. However, if that data is part of your business'competitive advantage when you are building AI capabilities, for example, it will be difficult to have full openness. Companies willing to share data with each other often overcome this barrier by creating joint ventures, for example. There are also a number of initiatives similar to those in Singapore, such as the creation of data marketplaces, platforms to facilitate the discovery and exchange of data sources among industry players.

CONCLUSION

From the above analysis, we see that a company needs to start its data and analytics journey with a clear vision that is closely aligned with the top priorities of the business. Visions need to translate into concrete cases, which can convincingly prove valuable. Big data doesn't need magical abilities, teams can be created with the right combination of skill types to replace a brilliant data analyst, for example. Businesses shouldn't feel obligated to do everything on their own, either, they should partner with their ecosystem to enrich both data sources and analytics.

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