SCOPING THE IMPACT OF DIGITALIZATION ON INTERNATIONAL BUSINESS ENVIRONMENT

Abstract

While the scholarly understanding of the representation level entities (like platforms, social network systems, and industrial internet) of digitalization is already nascent, the deeper drivers of the phenomenon are still notably ignored in IB research. This article explicates three fundamental drivers (datafication, digitizing and connectivity) of the socio-technical phenomenon labelled digitalization, and further explores the potential impact scope of those drivers through utilizing an analytical tool (Causal Layered Analysis, CLA) adopted from the field of futures research. In doing so, the article contributes to the scholarly discussions attempting to unravel and understand the contemporary socio-economic turbulence, especially through viewing the role of technological advances in transforming the economic landscape. It is the claim of this article that without understanding the role and potential impact of technological advances, explanations grounded on political, social and economic trajectories do not yet yield a full picture of the current changes in the international business environment.

Introduction

For a short while in the previous century it seemed that the post-Enlightenment humanity had hit the philosophers' stone of continuous progress and prosperity for all. The scientific paradigm seemed a cornucopia of insights driving productivity increasing technological developments, the financial innovations enabled investing in the always more productive future, and the democratic paradigm coupled with the faith in the invisible hand of market seemed to ensure the diffusion of the fruits of the increased productivity more widely than ever in the history of mankind.

Now, however, none of these fundamental drivers seem flawless. As a side effect of technological prowess we are at the brink of destroying the livability of our planet (IPCC, 2018). The financial innovations turned out to be built on legs of clay, as illustrated by the global financial crisis a mere decade ago (Lane, 2013). The example of China suggests that the western democracy is not the only route to economic might (Kobrin, 2015), and the anti-democratic developments in the nations such as the US and UK, touted as the torch-bearers of democracy under-

mine the desirability of the notion even more (Kobrin, 2017, Rodrik, 2018). Even the infallibility of markets is threatened as the future of the core notion of inaccessibility of all market knowledge (Hayek, 1945) seems questionable considering the advances in datafication, digitizing and algorithmic processing of digital data (Zuboff, 2015).

In sum, our age is characterized by an amorphous, overwhelming sentiment of unraveling, the loosening of the whole fabric of society, economy and geopolitics as we used to know them. The threads coming loose are myriad, with complex interconnected causes and effects difficult to disentangle enough to grasp. In his recent article, Rodrik (2018) chases one of these threads, namely the economic antecedents of populism, to increase our understanding of how the economic globalization has driven one phenomenon contributing to our current sense of unease. However, like Rodrik notes, the economic globalization is but one driver. Another, at least equally notable, is the trajectory of technological developments as ubiquitous computing (Lyytinen and Yoo, 2002, Yoo, 2010), often summed up as digitalization.

It is the aim of this article to try to understand the scope of the impact that the phenomenon often labelled as digitalization has on this contemporary sentiment of unraveling. Are we living in an era of a technology driven social paradigm change, and if so, what are the roots of that change? What is the role of these technological advances in picking apart the fabric of economy and geopolitics as we used to know them? And ultimately, what is the scope of impact of these current technological developments? After all, the humanity has always been inching forwards by coming up with new technologies, only few times resulting in paradigmatic level change in our societal existence: are we witnessing one of those, or is digitalization just noise, covering and contributing to other sources of increased uncertainty?

To begin with, the concept of digitalization needs defining. Digitalization as a concept is quite blurry, as in different contexts the word is used to label sets of quite different contents. This usage of the concept reveals more than a mere semantic issue: while the individual presentations of the phenomenon intertwined with the advances in information and communications technologies are ubiquitous in our daily life, the entity of the phenomenon is still evading full scholarly comprehension. In this article the concept of digitalization means a sociotechnical (Geels, 2002, , 2004, Geels and Schot, 2007, , 2010, Leonardi and Barley, 2010, Leonardi, 2012) trinity of technological systems, humans as users and developers of those systems, and the perceptions of the humans in guiding the use and development of those systems (Lyytinen and Yoo, 2002, Tilson, Lyytinen & Sorensen, 2010a, , 2010b, Yoo, 2010).

In this theoretical thinking piece, the focus is on explicating the drivers of digitalization, namely datafication, digitizing and connectivity, and in assessing the potential of those drivers to bring about revolutionary change. In order to do that, this paper opens up by providing a

layered understanding of digitalization, proceeds by borrowing the analytical tool of Causal Layered Analysis (CLA) (, 2004, Inayatullah, 1998b) from the futures research, and subsequently discusses the scope of impact of digitalization with the help of that tool. The theoretical contribution aims are what MacInnis (, 2011) names integrative, in essence bringing together knowledge from diverse sources to enable seeing an entity more than the sum of its parts.

Ultimately, this article seeks to contribute to the depth of understanding of digitalization within the field of international business. Extant research within the field has primarily been focused on independent representations of the wider phenomenon, presenting insights about firms labelled ibusiness (Brouthers, Geisser & Rothlauf, 2018), the impact of technological advances on global value chains (Laplume, Petersen & Pearce, 2016) or mapping the changes in internationalization onto the established OLI-paradigm (Alcácer, Cantwell & Piscitello, 2016), to name a few examples, however the overall discussion of the deeper drivers of digitalization and potential implications thereof emerging is still quite modest. It is the aim of this paper to introduce such a conceptualization about digitalization that, in its small way, enables creating more profound understandings about the impacts of technological advances on international business.

Layered understanding of digitalization

In this article digitalization is viewed through a metaphor of a tree. The foliage of digitalization tree consists of the myriad representations abundant in both scholarly and lay parlance: the branch of social network systems sprouts leaves like Facebook, Twitter, LinkedIn to name a few familiar to most, the branch of platform economy is covered in leaves such as AirB'n'B, Über, and the branch of industrial internet or IoT is pushing fronds scrutinized from several vantages. Concepts like cyber security, sharing economy, 5G, autonomous vessels, 3D printing, to mention but few, are also examples of the already extant representations that have yielded themselves to be researched from various viewpoints. In short, most of what we know about digitalization consists of piecemeal insights about the various actualizations of the deeper phenomenon.

To understand the depth of digitalization, paying attention to the trunk and roots of the tree is necessary. The trunk consists of digital infrastructures (Tilson, Lyytinen & Sorensen, 2010a, , 2010b), which in turn emerge from the convergence of the three main roots of digitalization, datafication, digitizing and connectivity, examined next.

Datafication (Van Dijck, 2014) refers to the act of giving physical, subjective and intersubjective (Popper, 1979) objects a data form representation, a feat in itself as old as writing or

calculus. However, with the current technological advances the humanity has taken a major leap forward in its ability to render nigh everything into data. Newell and Marabelli (, 2015) identify two main sources of data, whereas Zuboff (, 2015) points out further three. The first source of data are the developments in sensor technology (Abbas, Michael & Michael, 2014, Linturi, 2016) enable datafying the physical objects even to the degree where it is possible to from distance analyze the level of alcohol in the blood of a driver in a passing by car (Hewitt, 2014). The sensors enable datafying the actions and qualities of the largest and farthest entities, as well as yielding data from the most minuscule movements of brain neurons, making it possible for the machine to read thoughts (Sundaresan, 2017).

The second source of data is notable also because it enables datafying subjective and intersubjective entities. All human interaction with digital technology leaves a trace of data. In addition to the traces left wittingly by for example typing a word into a search engine (Pariser, 2011), also the pauses in browsing for example a social media site leave a trace that may reveal a subjective sentiment: even if one doesn't click "Like" in reading a post of Facebook, the mere pause in stopping to view the post registers as data about the potential subjective interests of the individual (Cadwallar and Graham-Harrison, 2018, McNamee, 2018, Sunstein, 2018). The datafication of intersubjective entities such as collective values or norms emerges from the pattern detection capabilities of the data processing algorithms – processing the vast amounts of data left wittingly or unwittingly by individuals (Chen, Chiang & Storey, 2012), it is possible to identify correspondences between diverse groups of individuals and their preferences, a feature driving the so called echo chambers and filter bubbles (Flaxman, Goel & Rao, 2016).

The three remaining sources of data identified by Zuboff (2015) are the traces left by automated (economic) transactions, the feed from surveillance systems (Lyon, 2001, , 2015), and the public and private legacy data repositories containing data in analog form. Viewing the heritage repositories containing analog data as novel data sources leads us towards the second driver of digitalization, namely digitizing.

In short, digitizing refers to the act of homogenizing the data from entities of diverse qualities (Kallinikos, Aaltonen & Marton, 2013). One pivotal moment in the ensuing digitization can be traced to the first Macy conference in cybernetics in 1946, when John von Neumann stated that it is possible to code all information directly into binary form (Peters, 2014): assigning any information signal a threshold value enables endowing all values above that the value 1, and below that the value 0 (e.g. sun above horizon equals 1, below horizon 0). Independently, yet simultaneously, the advances in pulse-code modulation (Wikipedia, 2018) enabled the digital representation of analog audio signals, paving way for not only subsequent developments in digital audio, but also in the methods with which highly different analog signal types can be

converted into digital data. The importance of this insight results from freeing the process of digitization from the middle man of language, elemental in for example the Morse code (Peters, 2014). The subsequent, exponentially accelerated development in digital technology is fundamentally underpinned by this notion: any form of information signal can be made digital. And because any form of information can thus be expressed in a similar format, in theory, any form of information can be processed with same technology (Tilson, Lyytinen & Sørensen, 2010b).

These enablers of datafication and digitizing are not in themselves enough to drive the phenomenon of digitalization, but with the addition of the developments in the communication technologies, connectivity, the picture changes. Like the root of datafication, communication technology has history as old as man – from the signal fires to message pigeons, from the first telephones to the first linking of early computers, the pace of developments have accelerated while the fundamental desire has remained the same. The current technological developments have resulted in a convergence of information and communications technologies (Herzhoff, 2009): information technology refers to the hardware and software used to store and process the data, and communications technology refers to the electronic means of transferring that data between diverse actors (Huang *et al.*, 2012), including network and data transfer technologies ranging from radio waves to the new applications utilizing light (Wang, 2017). The notable innovation of internet protocol vanguarded this convergence of information and communication technologies by standardizing how the digital data should be packetized, addressed, transmitted, routed and received, resulting in the interconnectedness of previously disconnected computer networks.

As noted before, these roots converge in the trunk of the tree as digital infrastructure. Taking the lead from the discussion pivoting around the invisibility of IT artefacts (Orlikowski and Iacono, 2001), Tilson et al (2010a, 2010b) draw attention to a paradox: while the digital technology has during the past few decades penetrated the environments of our lay existence, the industrial settings and the market spaces to a degree nigh equal to the presence of electricity, plumbing or roads, the level of penetration has resulted in the taken-for-grantedness of digital technology, rendering it in practice quite invisible. The omnipresence and amorphousness of digital inftrastructures makes it difficult to conceptualize them as artefacts solid and bounded enough to yield themselves to scholarly scrutiny.

In their call for increased scholarly attention, Tilson et al pave the way by identifying the nested nature of infrastructures. There is the physical layer infrastructure, the physical representations of the infrastructure like cables, computers, sensors – or books, bookstores and printing machines in the analog realm; the logical (or code) layer infrastructure (like the IP protocol underlying internet or the publishing systems in the analog realm) that drives the developments

physical layer infrastructure; and the layer of multiform content as alphanumerical or trans-semiotic data like sound, image, social network system interaction tokens, to name a few examples (Constantiou and Kallinikos, 2015). Tilson et al further claim that the distinguishing feature of digital infrastructures (in comparison with the more historical infrastructures) is their openness as systems: most traditional infrastructures are closed systems whereas the uniform coding of digital data as binary digits affords an unforeseen open infrastructural system. It is exactly this open system nature of digital infrastructures that renders them difficult to define because at any given moment the system may change due to changes introduced in any of its components.

To recapitulate before moving on to assess the level of impact of digitalization, digitalization is in this article conceptualized as a sociotechnical entity consisting of the foliage of applications, the trunk of digital infrastructures, and the roots of datafication, digitizing and connectivity. Because the developments in the infrastructures drive the developments in the applications, and the infrastructural developments are in turn driven by the convergence of the three fundamental trends, the subsequent discussion focuses on understanding the potential implications emerging from the trajectories of datafication, digitizing and connectivity. However, first this article takes a detour through future studies to next introduce the chosen tool of analysis.

Causal Layered Analysis (CLA) in a nutshell

The Causal Layered Analysis (hereafter CLA) is a futures research method crafted by Sohail Inayatullah (, 1990, , 2004, Inayatullah and Milojevic, 2015, , 1998c). Grounded on the science genealogical and archeological approaches of Foucault, the method distinguishes between four different onto-epistemological levels, all perceived to exist simultaneously, each providing a set of lenses through which a phenomenon can be understood. As such, the method as an analytical tool can be used in trying to understand such objects of enquiry, which can be perceived to consist of several dimensions difficult to view through any one chosen set of onto-epistemological lenses (Morgan and Smircich, 1980). Considering the complex sociotechnical nature of the phenomenon of digitalization, the CLA enables viewing several of its aspects through diverse perspectives, thus hopefully contributing to a fuller understanding of the elusive entity.

The simplest way to explain CLA is to analyze a familiar phenomenon with it, and as the Trump election is something most readers are most likely familiar with, next that example is used to show the mechanisms of CLA. However it should be noted that the interpretations written below do by no means claim to present truth claims, but are used merely to illustrate the mechanism and potential of the CLA.

The top level of CLA is called litany, and it consists of the empirical observations of a phenomenon, the part that makes the headlines. In this case the litany is "Trump won the presidential elections". This layer is something that be validated through positivist epistemologies, something that most observers can agree to perceive as ontologically real, something that allows even for the naïve version of reality.

The next level of CLA is social causes, and this is the level of most scholarly endeavors. In Trump's election, the causes are seen as dissatisfaction of the losers of the globalization (a sophisticated example of this level of discussion is the article by Rodrik (2018) already mentioned in this paper), and the rebellion against the prevailing establishment doing nothing to remedy the situation. Untangling the social causes is a complex process and allows the wielding of several epistemological methodologies: through positivist approaches some hypotheses can be validated or disproved, through constructivist approaches the roles of individuals and social structures can be unveiled. Equally, for example the class theories of Marx or the institutional approaches can be used on this explanation level.

The third level, named worldview is the first level to invoke the deconstructive insights from Foucault. In this level the question is, what are the worldviews of the individuals involved in the phenomenon at hand, and how did those worldviews contribute to the emergence of the phenomenon. At this level of analysis we can zoom into the life of a disgruntled coal miner to understand the impacts of both his personal traits and his institutional biography to see how he views the world. Equally we must zoom in to the lives of the voters of Clinton, to understand their perceptions of reality. What we gain as a result is an insight into how these different worldviews have interacted, interact and will in the future interact. It is not because of the different circumstances of the voters that they voted as they did, but it is because of the worldviews through which they viewed the events that resulted in the voting.

The fourth level is named myth/metaphor[1]. Essentially the question asked on this level relates to the emergence and identification of such powerful myths that are partially responsible for creating the worldviews in interaction with lived circumstances and idiosyncratic personal features of individuals. For example, the "land of opportunity" and "self-made man" myths illustrate such metanarratives (Lyotard, 1984) on which the American culture has in big part

[1] Both third and fourth levels of analysis follow deconstructive approach, however they differ in the unit of analysis: in the worldview level the unit of analysis is the individual, including both the personal (eg. cognitive) features and the social forces constructing the worldviews, whereas in the myth/metaphor level the unit is the collective, more particularly the metanarratives contributing (as elements of social forces) to the shaping of the individual level worldviews.

been founded. These myths appeal to emotions and as such are powerful contributors to the worldview. Trump's campaign evoked several of these myths drawing their power from the emotions, the gut reactions: the perception of Trump as the ultimate self-made man personifying the American dream, thus creating an idol to follow, the externalizing of the obstacles in the path to self-made happiness by constructing enemies (Mexicans, the government and "elite"), and the upholding and bolstering of such metanarratives as Americans as the "chosen people" ("America first!") that appeal to the sense of self-worth of individuals.

For its original designer Inayatullah, the method is first and foremost a discursive tool to create transformational spaces. This means that none of the levels has priority over another, but that the whole idea is to move down and up through the levels in order to create a fuller understanding of the phenomenon under scrutiny between the diverse participants exploring the issue[2]. Understanding the causalities vertically and horizontally, within and in between each level gives rise to different future possibilities: an issue can be solved in different way on each level of analysis, the timeframe of changes becoming longer towards the bottom.

One interesting thing is that when the issue is first analyzed through CLA, not only are the different potential solutions visible on every level, but also the choice of perspective becomes pronounced. What is the problem we are seeing, and according to who? Subsequently, when solutions are presented, the discussion of from whose perspective this would be a solution needs discussing. These discussions are at the core of the transformational spaces CLA aims at creating in the setting in which it is used (Inayatullah and Milojevic, 2015), and this is the way in which CLA surpasses the cynicism of post-modernism. Adding the question of "why do I see the issue the way I see it?" brings this approach very close to Bourdieu's idea of reflective sociology, his proposed way out from the impasse of deconstructionism (Ahonen, 2001, Bourdieu and Wacquant, 1992).

As an example, on the litany level, the problem could be that Trump is president or that his attempts are being thwarted. As such, the solutions would respectively be to either remove Trump of the ones stopping him. On the level of social causes, one exemplary solution could be to help the unemployed and marginalized back to the society by creating new jobs, however depending on the perspective, that would either lead to re-opening the coal mines and hindering globalization (pro-Trump strawman), or to coming up with new jobs and encouraging people to study so that they would be able to work in such fields that are not under the threat of being

[2] CLA is mostly used in workshop settings, where the diversity of participants helps in creating a more multifaceted understanding of the issue. However it is also used as an analytical tool by individual researchers, which essentially means that the researcher using it needs to be able to see the issue from multiple perspectives.

outsourced (anti-Trump strawman). These solutions are much slower to execute than just removing the undesired element.

On the level of worldview the problem changes to how can we make others understand our point of view? The solutions shift the focus to increasing equality, developing and harmonizing basic education – essentially viewing the social institutions responsible for creating social fragmentation with the attempt to change those institutions towards more cohesive directions. The discussion must also include a profound negotiating of the values, standards of desirability included in the cohesion building efforts – or the discussion of the desirability of such efforts in the first place. As such, the solutions are far more difficult and slower in unfolding than on the upper levels.

On the level of myth and metaphor, it is debatable whether the changes can be triggered intentionally, or whether the underlying metanarratives just evolve gradually. Any solutions on this level would therefore require changes in the meaning of the emotion evoking national identity forming myths of "self-made man" and "land of opportunities". However, the potential changes would take decades, centuries to unfold. While the ability to influence the developments and evolution on the deepest level is questionable, understanding the impact of the level of myth/metaphor is nevertheless essential in creating a rich picture of a complex social phenomenon. Now equipped with the basic outlines of CLA, next this article endeavors to do just that – paint a fuller picture of the potential scope of impact of the sociotechnical phenomenon of digitalization.

The scope of impact of digitalization

To begin the dissection of scope of impact of the sociotechnical phenomenon here addressed, a very macro level approach serves the purpose well. A Russian economist, Nikolai Kondratieff proposed in the 1930's that the human society progresses in waves, driven first by technological paradigm changes, resulting in economic, social and political transformations (Kondratieff, 1979). The subsequent K-wavers propose that we are currently entering a sixth Kondratieff wave, driven by the digital technology (Wilenius and Casti, 2015). One depiction of the phenomenon is illustrated in the following figure.

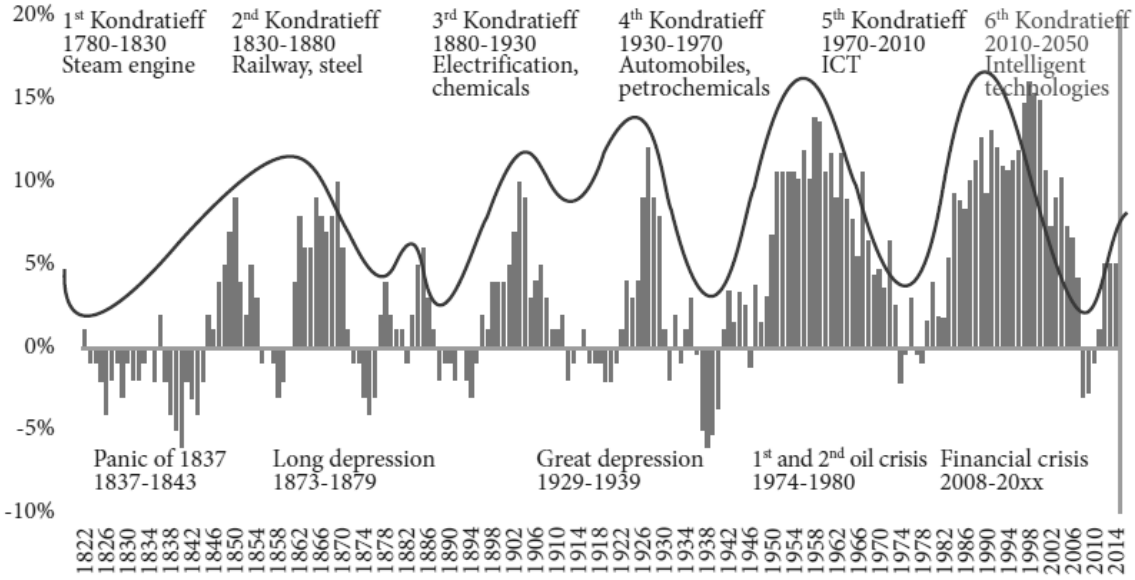

Figure 1: Kondratieff waves in Wilenius and Casti 2015, p. 339

In the figure above, the percentage relates to the Standard&Poor equity index, with the Kondratieff waves following both the technological innovations driving economy, and diverse economic shocks weakening the hold of current dominant technologies, making way for new technological paradigms (Wilenius and Casti, 2015). The message of the figure is that at any given point in time, the economic capital is intertwined with the dominant technological infrastructure, supported by the social and political systems. Either through the dwindling of the potential of the current technology to create more financial benefits, or through a shock, the new innovations gain a foothold (the creative destruction (Schumpeter, 1934)), gradually becoming the next dominant technological paradigms, followed and further strengthened by the economy and socio-political systems. The current transformation would therefore be grounded on the shock of the financial crisis in 2008-2010 creating space for new economic players relying on novel technological avenues, most notably the digitization referred to in this figure as intelligent technology.

While the mechanism is generally accepted, there is however no unanimous agreement about the number or break-off points of Kondratieff waves among scholars (Barnett, 2016, Korotayev and Tsirel, 2010), or of the mechanism through which the waves emerge (Ayres, 1990a, Ayres, 1990b), or for example of the impact of globalization on the potential of a uniform impact of any given technological paradigm change (Ayres, 2006, Dator, 2006). However, the discussion is in principle grounded on similar thinking as the rapidly diffusing concept of Industry 4.0. The difference between the discussions arise from the chosen perspectives: where the K-wavers view the economic developments, as the concept suggests, the Industry 4.0 discussions focus on the operational changes.

The origins of the notion of fourth industrial revolution emerged from the German car manufacturing industry (Gilchrist, 2016, Kagermann *et al.*, 2013, Kagermann, 2015), almost simultaneously diffused globally as a concept capturing the anticipated changes in industrial production (Brettel *et al.*, 2014, Hermann, Pentek & Otto, 2016, Lasi *et al.*, 2014, Schwab, 2016). The first industrial revolution refers to the mechanization in the mid 18th century ("Spinning jenny"), the second to the coinciding introductions of electricity and distribution of labor in the change of the 19th and 20th century (Taylor, F. W., 1914), and the third to the adoption of personal computers from 1970's onwards[3].

The current era, characterized by what in this paper loosely defined as digitalization, is in this stream of research *ex ante* identified as driving a fourth, "revolutionary" change in the organizing of production. Essentially the fourth industrial revolution discussion highlights the automatization, autonomization and robotization of manufacturing, facilitated by the industrial Internet-of-Things, and the servitization (Vargo and Lusch, 2004) of the offerings.

While the approaches of Kondratieff waves and fourth industrial revolution are grounded on a very macro level analysis, the Multi Level Perspective (MLP) introduced by Geels (Geels, 2002, , 2004, Geels and Schot, 2007, , 2010) focuses more deeply on the actual process of socio-technical transformation. The MLP views the phenomenon on three different levels: wider environment, socio-technical regime (current dominant technology infrastructure, its users, diverse stakeholders and beneficiaries in terms of power coalescence), and emerging innovations, depicted in the following figure.

[3] Albeit it should be noted that there are also other cut-off points recognized as revolutions under the buzzword of Fourth Industrial revolution. Some begin with the agricultural revolution, whereas others begin only with the diffusion of electricity, however the cut-off points here explicated seem to be the most dominant version of the concept. For the sake of this discussion pinning down the revolutions "correctly" is not important, as regardless of the cut-off points, the notion is the same.

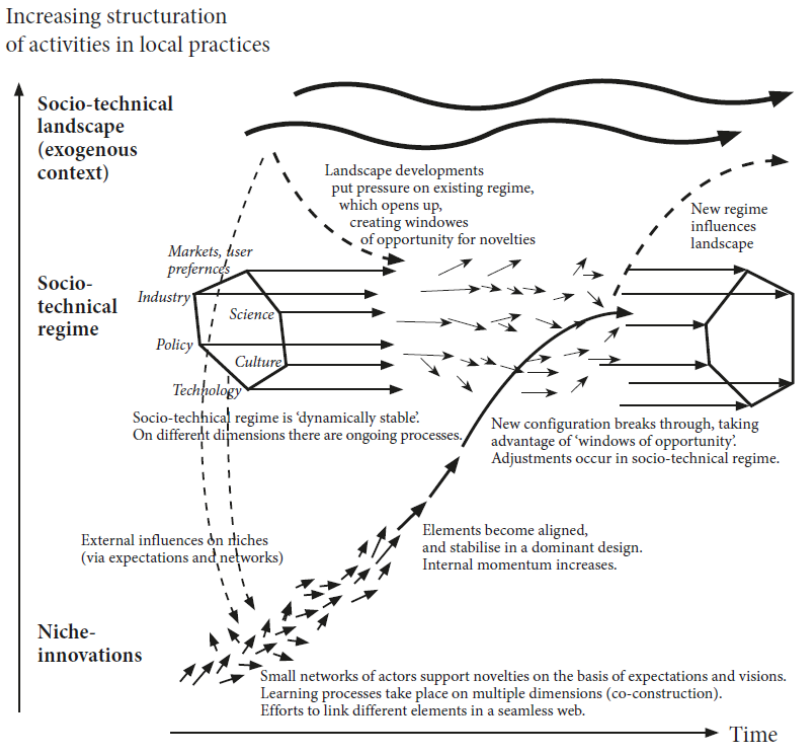

Figure 2: Multi Level Perspective on socio-technical transition in Geels&Schot 2007, p. 401

Building on the notion of technological regime by Nelson and Winter (, 1982), the core idea is that at any given point in time, the overarching socio-technological landscape is given stability by the dominant socio-technical regime constituting of engineers, scientists, policy-makers, users and other stakeholder groups and the embedded formal (regulative) and informal (normative, cognitive) institutions (North, 1990, Peng, Wang & Jiang, 2008, Scott, 2008) shaping the development and usage trajectories. This socio-technical regime is influenced by niche innovations, some of which get diffused enough to gain such momentum as to replace or transform the established socio-technical regime, resulting in changes in the overarching socio-technological landscape. This approach underpins also the discussions in Linturi *et al* (2016), which tracks the potential of radical technologies to create notable changes in the diverse value networks – in other words looking at how the niche innovations and the socio-technical regime interact.

Moving in towards viewing the diffusion of technology on the individual level, the rich research stream of technology adoption in the field of information systems provides ample insights of the more or less deliberate and witting acceptance of technology. One of the earliest models explaining the differences in the adoption of technology dates to the early 1960's (Rogers, 2010), when Rogers identified five different types of innovation adopters and positioned them onto a Gaussian scale ranging from innovators and early adopters to early and late major-

ity, tailed by the laggards. Moore (, 1991) discussed the notion further and introduced the concept of "chasm" in between the early adopters and majority, highlighting how difficult it is to diffuse an innovation, to reach the critical mass constituted of the early and late majorities required for realizing the main benefits of a given technology.

Subsequent research about the individual and organizational level of sociotechnical systems (Leonardi and Barley, 2010) abounds from several perspectives: how individuals within an organization adopt new technology (Oliveira and Martins, 2011, Venkatesh and Davis, 2000), how consumers adopt new technology (Curran and Meuter, 2005, Taylor, S. and Todd, 1995), or how the individual perceptions and features impact the adoption (Agarwal and Prasad, 1998, , 1999, Davis, 1989). In addition, the more constructivist approaches of sociomateriality view the interplay of humans and technology as amalgams where the affordances of technology shape and are shaped by the human enactment (Orlikowski, 2010). Reviewing all these insights falls out of the scope of this discussion (for a concise and comprehensive overview of technology acceptance and adoption see for example (Mäntymäki, 2011), and for a review of the sociotechnical literature (Leonardi and Barley 2010)) as the focal point of this article is not to explore why does an individual use a specific technology. Instead, next we turn towards the question of the level of the changes digitalization creates.

Viewing these four perspectives together highlights the nested nature of diverse approaches to how technological novelties impact humans. The following figure summarizes these approaches by positioning them on the axes of time and impact.

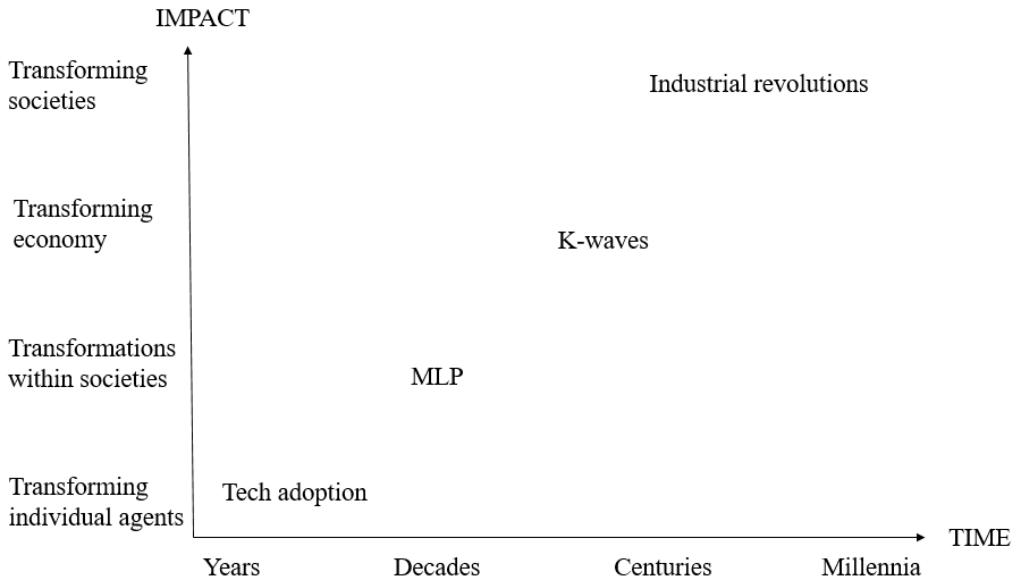

Figure 3: Nested approaches to technology driven changes

In the technology adoption and sociomateriality literature (Davis, 1989, Leonardi and Barley, 2010, Venkatesh and Davis, 2000), the units of analysis cover the individual technologies,

the individual humans and the individual organizations. The discussions highlight the interaction of humans and technology, how and why individual humans engage with technology, and what are the implications of this engagement for the firms and organizations, including their operations, emerging sociotechnical systems and the financial outcomes. The scale of impact is therefore on the level of individual agents and the time scope spans years.

The multilevel perspective (MLP) (Geels, 2004) has a wider scope as it explores the change processes within societies: the relationships of existing socio-technical regimes and the niche innovations. The units of analysis are the socio-technical landscape, the socio-technical regimes and the diffusion of niche innovations, which means that the changes are traced through decades, and the scale of impact covers the existing societies, for example on the level of nations, regions or bounded through the criteria grounded on the definitions of the socio-technical landscape or regimes.

The literature on the Kondratieff waves (Wilenius and Casti, 2015) in turn doesn't focus on the boundaries of the societies as defined through socio-technical landscapes of regimes, but instead views the fundamental drivers and principles of the economic organizing. While the discussions include the impact of technological innovations, the time span of the changes is longer, covering centuries. The scale of impact is also even more profound, as the economic structures cut through and shape the different socio-technical entities – while naturally also being shaped by them (Giddens, 1984).

While the discussions under the label of the fourth industrial revolution (Kagermann *et al.*, 2013) pivot primarily on the current era and the anticipated changes in the organization of production, work, economy and societies, viewing the impact and timing of the identified revolutionary drivers positions this approach on the widest macro level. The three revolutionary drivers of mechanization, electricity and division of labor, and computerization can however be complemented with additional, equally fundamental changes going back millennia: the initiation of agriculture, the development of writing and calculus, and the introduction of money to list at least a few equally fundamental development stages (Diamond, 1999, Freeman and Louça, 2001, Fremantle, 1992, Harari, 2014).

The concept of revolution in these contexts needs some explicating: if revolution is considered a sudden phenomenon, the notion doesn't apply, as it took time for these drivers to evolve and impact the overarching organizing of human existence. However, if we view humanity before and after the unfolding of these "revolutions", the impacts each has left in their wake are truly revolutionary. The human civilization before and after agriculture, writing, electricity or computers looks profoundly different.

The relevant question for the overarching discussion of this paper then emerges: at what level of transformation could and should the digitalization be viewed? If we define it through the changes it as sets of technological advances has on the humans, at what level do those changes in humans occur? Individual, within set social boundaries, within economy or on the very macro level of societal transformation?

The discussion of the infrastructural nature of digitalization highlights this question, claiming that the digitalization isn't driven by merely the deliberate adoption of specific technologies, innovations or applications (Tilson et al 2010a, 2010b). Instead, the digital technology is creating a society, where becoming a user is no longer a choice (Yoo, 2010). The same can be said about electricity or sanitation, long ago established as the taken-for-granted essentials of western life. The focal point is that like in the history of electricity, no electric technology *per se* was responsible for the fact that we now run on electricity – equally, no digital technology *per se* is necessary for the future developments theoretically culminating in full digital convergence.

To understand the potential scale and scope of the impacts of digital technologies on humans, I evoke the Causal Layered Analysis (Inayatullah, 1998a). In the following table I will try to identify the layers of changes created by some previous revolutionary developments, in order to see if similar layers can thus be identified from the ongoing phenomenon of digitalization. This requires reconceptualizing the layers to encompass not only the endogenous dimensions captured in the original version, but to list also the exogenous drivers evidenced across layers, explained next.

As explained in the previous chapter, Causal Layered Analysis is a tool developed in the field of futures research that enables analyzing a phenomenon through diverse perspectives – including diverse different philosophical approaches. The top level of litany includes the immediate appearances of a given phenomenon and the social causes are the causes that can be traced to create the appearances of the phenomena as effects. The layer of world view captures the underlying assumptions and perspectives that enable seeing and enacting those causes, and the fundamental level of myth/metaphor explores the metanarratives responsible for creating those worldviews.

As such, the CLA is primarily focused on endogenous themes, meaning the assumption, perceptions, standards of desirability and meaning making mechanisms – the internal drivers of agentic action. However, in order to utilize it in viewing these revolutionary changes in the organizing of human production and economy, the impact of the more exogenous drivers – the structural drivers of developments – on the very bottom level, and on the level of the causes is required. There are exogenous changes that have an impact on the endogenous changes, which

in turn drive and shape the endogenous perceptions further impacting the evolution of the exogenous drivers.

In the following table, the layers are therefore named as follows: litany, the top layer covers in itself already the exogenously detected appearances of the phenomena under scrutiny, in addition to entailing also the immediate interpretations given endogenously. Social causes capture the endogenous divers of human actions, but they are complemented with structures, exogenous elements which shape and are shaped by the endogenous elements (in short, capturing the essence of the structuration theory (Giddens, 1984)). The worldview, by definition deals with the underpinning assumptions, being purely endogenous, whereas it is not only the endogenous myths and metaphors that drive fundamental change, but also the exogenous enablers that become woven into the endogenous myths and metaphors, again following the intertwining of structuration theory.

The following table captures two established moments of change in the human history, the agricultural, or neolithic revolution, and the second industrial revolution. Both eras can be defined as revolutionary based on the subsequent impacts, while neither of the eras are revolutionary in the sense of being clearly definable events. The roots and sprouts of these eras span backwards and forwards, however with a clustering in a definable period, creating some semblance of time boundaries.

Table 1: Adapted CLA of agricultural and second industrial revolutions

Phenomena Layers	Neolithic revolution	Second industrial revolution
Litany (endo&exo)	Civilization as we know it	Business as we know it
Social causes (endo)	Growing size of collectives, specialization of labor	Taylorism
Structures (exo)	Cities, villages	Mass production
Worldview (endo)	From nomadic to location bound lifestyle	Society as machine
Myth/metaphor (endo)	From hunting to harvesting	Might of scientific approach
Fundamental enablers (exo)	Agriculture (taming wheat)	Electricity

The agricultural revolution spans millennia in its unfolding (appr. 12 500 – 5 500 B.C.), however compared to the preceding millions of years spent hunting and gathering, the transformation was rapid. On the level of the litany, the outcomes of the agricultural revolution are the farms and cities that restructured the social hierarchies and organizing, and created what we currently refer to as civilization (Weisdorf, 2005). On the level of social causes and structures,

we see the growing size of human collectives, enabled by farming and organized into the new structures of villages and subsequently cities. The increasing size of growing collectives was underpinned by the changes in the worldviews, the shift from viewing the nomadic lifestyle as the norm, to seeing the location-bound, sedentary lifestyle as the norm. The fundamental enablers driving these changes were the taming of the wild plants and animals, and the idea of agriculture: instead of pursuing, food could be grown. (Diamond, 1999, Harari, 2014).

The second industrial revolution in turn spanned decades (early-to-mid 19th to early 20th century), if not a century – again a lengthy period in itself, yet a mere blink of an eye compared to the rate of the preceding industrial developments. On the level of the litany, the era saw the emergence of the factories, industries and firms of contemporary form, the outlines of the economic realm as we currently know it. The social causes underpinning these developments were the introduction of the scientific management, Taylorism, and the emergence of mass production, facilitated by the technological advances of the era. These changes were underpinned by changing worldviews: society began to be seen as a machine, where the individuals of the era where required as the clogs to spin the wheel, and the societies reformed in ways (eg. by initiating mass schooling to create the necessary factory work force) to enable that. The fundamental enablers of this revolution were the developments in the scientific mechanisms[4] and the technological advances that enabled for example harnessing the power of electricity. (Freeman, 1997, Freeman and Louça, 2001, Mokyr, 1998, , 2000).

Now, viewing these fundamentally transformative eras in human history through the four levels of the causal layered analysis, how do the changes created by digitalization look like if positioned into the same table? While we cannot yet know the future consequences of the currently unfolding events, is it possible to identify such layers of digitalization that would enable anticipating whether the impact of digitalization on the humanity should be viewed through its impacts on the individual, within societies, on the economy, or on the societal structures themselves?

[4] Like Mokyr put it "*The first Industrial Revolution – and most technological developments preceding it – had little or no scientific base. It created a chemical industry with no chemistry, an iron industry without metallurgy, power machinery without thermodynamics.*"(Mokyr 1998, p. 1)

Table 2: CLA of revolutions and digitalization

Phenomena Layers	Neolithic revolution	Second industrial revolution	Digitalization
Litany (endo&exo)	Civilization as we know it	Business as we know it	Individual technologies and applications, "the foliage"
Social causes (endo)	Growing size of collectives, specialization of labor	Taylorism	Experiental computing, two-way interaction between humans and digital infra
Structures (exo)	Cities, villages	Mass production	Digital infrastructures
Worldview (endo)	From nomadic to location bound lifestyle	Society as machine	Convergence
Myth/metaphor (endo) Fundamental enablers (exo)	From hunting to harvesting Agriculture (taming wheat)	Might of scientific approach Electricity	Datafication of everything Digitization Connectivity

Beginning again at the level of litany, it entails the contemporary discussions and representations of diverse digital technologies, applications and advances. The discussions are myriad and range from the developments in the specific technologies to the applications and implications, such as the emergence of the platform economy or the digital business ecosystems. As the technological advances, applications and implications are numerous and complex, this corner of the matrix is richly populated in both scholarly and practitioner-oriented literature.

On the second level of causes, the exogenous structures consist of the exponentially increasing computing power, standardization of data and technologies, and internet, supported by the advances in the connectivity. These structures shape and drive the individual developments evident in the level of the litany. On this level, the social causes include the emergence of what Yoo (2010) names experiental computing: people no longer think of using technology as an independent act, instead people go about their daily lives facilitated by ubiquitous technology as part of mundane routines.

A focal social cause is the two-way interaction between humans and digital infrastructures, best explained by comparison: there is a major difference between the digital infrastructure and for example electricity. We only utilize electricity and do not constitute an integral part in creating the electricity infrastructure. In contrast, in intertwining our life with the digital infrastructures, we don't only use the technology, but are used by it and contribute to creating it (Newell

and Marabelli, 2015). It is our individual data, resulting from our interactions with and in the digital realm that through digitization ultimately powers Facebook, Google or Amazon, contributing to the creation of the digital infrastructure and the litany level applications.

On the level of the worldview, the most distinctive shift in perceptions can be captured through the concept of convergence. Entities previously considered separate are now seen as the same. The blurring of the boundary between digital and physical realities is maybe easiest to explain through the phenomenon of social media. Social life used to exist in the physical realm, in between the human encounters. However, following the emergence of the social media platforms, social networking sites, the digital interactions within them are not only representations of social relationships and hierarchies in the physical world, but instead constitute a realm of social life by its own right. The positive and negative dimensions of human interaction within social networking sites are equally powerful and "real", as their counterparts in the physical realm (Mäntymäki and Islam, 2016).

However, the perception shift of convergence isn't limited to the phenomenon of social media. We find nothing unusual in our ability to monitor the temperature of our house from afar through our mobile devices, to fulfill our transportation, accommodation or music listening needs with the aid of the same device, or to operate a full scale manufacturing facility through a few taps on a monitor. All of these actions used to consist of dealing with entities of different qualities, therefore in need of processing in different ways, whereas through digitalization the different qualities of physical realm entities have converged in ways that enable processing them through few multipurpose interfaces.

On the fundamental level of myth/metaphor, the endogenous force is the idea of datafication – everything is, creates and can be expressed as data. The fundamental exogenous enabler of this notion of mythic proportions is the act of digitizing, the transformation of any substance and event into binary digits. Fueled by the advances in connectivity, perceiving everything as data and representing it in binary digits drives the convergent worldview, creates digital infrastructures and seeds individual innovations and applications. In digitization, the core driver of these changes is not any specific technological innovation, but the possibility of full convergence inbuilt into the act of digitizing and connecting all types of data. The resulting social changes are actually not dependent on the choices of the individual to adopt or accept any digital technology, but ride on the historical waves that have led towards perceiving everything as data, coding all data in an ultimately uniform way, and connecting all that uniform data together.

Conclusion

So, when we compare the fundamental level of these three phenomena, neolithic revolution, industrial revolution and digitalization, how do the potential implications of the changes in the myth/metaphor/enabler level compare? Will the impact of datafication and digitization equal the impacts of adopting the scientific mechanism and harnessing electricity, and the adoption of agriculture?

We don't know. Your guess is as good as mine. However, in exploring this question the present article contributes to the nascent discussion of the impacts of digitalization within the field of international business by proposing a multilayered conceptualization of the phenomenon. Through the metaphor of digitalization as a tree consisting of the foliage of individual technological advances and applications, the trunk of digital infrastructures, and the roots of datafication, digitizing and connectivity, I have endeavored to illustrate the depth of the ongoing phenomenon in order to state the need for further scholarly advances in addressing also the deeper levels of digitalization in the field of international business. It is my belief that merely by increasing our understanding about the pervasive individual applications such as 3D printing, platform economy or social network systems we risk omitting the more profound changes to the social and economic structures driven by the technological changes of potentially paradigmatic nature.

The integrative aim of this article however bears an inherent problem in terms of assessing the scholarly value of this thinking piece: due to the exploratory nature of the topic addressing an emergent and evolving phenomenon, positioning this paper into any one stream of extant research is difficult, and due to the aim of painting a big picture, many of the extant insights about diverse details were not addressed. However, the key point of this article tackles the contemporary sentiment of unease discussed at the onset, and can be stated as follows: if we are interested in understanding the socio-economic changes driven by technological advances, mere scrutiny of the current applications of diverse technological developments is not enough – we need to understand the drivers underpinning the technological development trajectories.

To facilitate this pursuit, this article proposed three fundamental drivers, datafication, digitizing and connectivity (converging into digital infrastructures), to provide a few points of entry for further scholarly discussions focused on the deeper levels of digitalization. Only through properly identifying and understanding the drivers can we make sense of the representations, and only through making sense of the individual representations as parts of a bigger whole can we begin to stich a new fabric of understanding of the threads of wisdom currently unraveling.

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